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MARTYN (E. J.). **The Effect of DDT on the Pasture Cockchafer (*Aphodius pseudotasmaniae* Given) in Tasmania.**—*Tasm. J. Agric.* **22** no. 4 pp. 356–360, 9 refs. Hobart, 1951.

Experiments on the control of *Aphodius pseudotasmaniae* Given by means of DDT dusts were carried out in 1950–51 on pastures in the southern midlands of Tasmania, where this Aphodiid has recently become injurious [*cf. R.A.E.*, A **39** 410]. The dust, which contained 10 per cent. DDT on pyrophyllite, was mixed with superphosphate and applied on 13th February 1950, within a month of beetle flight and oviposition, with a horse-drawn distributor of the "spinner" type at rates giving 124 lb. superphosphate and 0·25, 1 or 2 lb. DDT per acre. All three rates of application caused significant reductions in the numbers of larvae present in July–August, and the two higher ones also caused reductions in July of the following year, that from the highest being significant. There was no reduction during the first year in populations of root-feeding larvae of the two main Melolonthid types, but in the following year, all rates caused significant and approximately equal reductions. This result was unexpected in the case of the lowest rate, and the persistence of the DDT may have been due to the very sandy, well-drained soil, in which adsorption is low. Indirect evidence that the reduction was caused by the DDT was obtained in another experiment, in which the effect of DDT applied at a rate of 0·5 lb. per acre to pasture infested by *Oncopera intricata* Wlk. persisted for at least eight months on heavy clay soil, which favours its deactivation.

The addition of DDT to the normal autumn top-dressing of superphosphate appears to be a cheap and effective means of controlling *A. pseudotasmaniae* in pasture. Work already noticed [**37** 221 ; **39** 40] indicates that DDT may be most effective against young *Aphodius* larvae, and to be most effective against *A. pseudotasmaniae*, it should therefore probably be applied early in the autumn.

MANEFIELD (T.) & MCDOUGALL (W. A.). **The Citrus Gall Wasp and Sodium Fluoroacetate ("1080").**—*J. Aust. Inst. agric. Sci.* **17** no. 4 pp. 220–221, 6 refs. Sydney, 1951.

Attempts to control *Eurytoma fellis* Gir., which occurs in coastal districts of northern New South Wales and southern Queensland and is injurious to *Citrus* in some parts of the latter [*R.A.E.*, A **25** 47, etc.], by means of insecticides applied against the ovipositing adults have not proved satisfactory, and the possibility of killing the young larvae before they construct their galls was therefore investigated. Sprays of benzene hexachloride, schradan (bis(bis-dimethylamino)phosphonous anhydride), parathion and 1080, a proprietary material stated to contain at least 90 per cent. sodium fluoroacetate, were applied at excess strengths, with and without a wetting agent, to grapefruit trees in early January 1951, when the new shoots were heavily scarred at the oviposition sites, gall formation had begun, and most of the larvae were in shallow pits in the woody tissue. Sodium fluoroacetate was the only material that gave any mortality, the kill reaching 60 per cent. three weeks after application at a concentration of 1 : 500 (w/w). Some of the older larvae that were in deeper pits and not in contact with the bark survived. Eight weeks after spraying, the trees appeared normal and compared favourably with untreated ones.

BECK (S. D.). **Nutrition of the European Corn Borer, *Pyrausta nubilalis* (Hbn.). II. Some Effects of Diet on larval Growth Characteristics.**—*Physiol. Zool.* **23** no. 4 pp. 353–361, 3 graphs, 31 refs. Chicago, Ill., 1950.

In the experiments described in this part, the effect of diet on moulting, the width of the head capsule and the ratio between head-widths in two successive

instars (progression factor) [*R.A.E.*, A **17** 178] in larvae of *Pyrausta nubilalis* (Hb.) was investigated. The insects were reared on a slightly modified form of the basal diet described in the earlier part [**39** 440], complete or with various constituents omitted. It was found that dietary deficiencies suppressed or retarded moulting or increased the number of moults, and that diets that prevented optimum increase in weight also prevented optimum increase in head-width. There was a constant correlation between body weight and head-width that was not dependent on diet, and it is concluded that the principal factor determining the width of the head capsule is the weight of the larva at the time of moulting, and not its instar. The correlation between instar and head-width was subject to great variation, depending on nutritional conditions. Head-width progression factors were not constant from moult to moult, but declined from the second moult and reflected differences caused by dietary deficiencies. From these results and a review of the literature on the growth of Lepidopterous larvae, it is concluded that Dyar's rule has no fundamental basis.

UVAROV (B. P.). **Locust Research and Control 1929–1950.**—*Colon. Res. Publ.* no. 10, iv+67 pp., 3 maps. London, H.M.S.O., 1951. Price 5*s*.

This booklet comprises the first connected account of the work on locusts in Africa and the Middle East with which the author has been closely associated since 1929. It includes an introductory review of the locust problem in various British Colonial territories, descriptions of the growth and activities of the research body set up in 1929 at the Imperial Bureau (now Commonwealth Institute) of Entomology that later developed into the present Anti-Locust Research Centre, reviews of the work of the five International Anti-Locust Conferences [*cf. R.A.E.*, A **27** 475–486, etc.] and other international and inter-territorial meetings prior to 1938, and accounts of the outbreaks of locusts in Africa and Asia and work against them with which the Centre was concerned.

The first series of these occurred in 1929–37, and comprised outbreaks of *Schistocerca gregaria* (Forsk.) in many African and Asiatic territories and *Locusta migratoria migratorioides* (R. & F.) and *Nomadacris septemfasciata* (Serv.) in Africa. Efforts at control were made by various territories, but they were not sufficiently co-ordinated to affect the course of the outbreaks. A further outbreak of *S. gregaria* began in 1940 and soon constituted a threat to the whole area in Africa and Asia over which this species ranges. As food production in East Africa was menaced, plans for a campaign were drawn up by the Centre, and various technical organisations were set up. These operated in Arabia, Persia and East Africa and received much co-operation from the governments of the territories concerned and similar bodies in other Middle Eastern countries, India and French North and West Africa. The results of these campaigns are reviewed. They showed in general the practicability of a planned co-operative offensive action against *S. gregaria*. Other sections deal with work against *Dociostaurus maroccanus* (Thnb.) in Cyprus and other parts of the Mediterranean basin and the establishment and work of the regional anti-locust organisations. These are the Desert Locust Survey [**40** 24], the Provisional International Council for the Control of the African Migratory Locust, and the International Red Locust Control Organisation [**38** 135].

The final sections comprise a survey of the progress in the study of locust problems achieved in 1929–50, with particular reference to phases, habits, distribution and control, and a discussion of further research requirements and the lines along which future policies of locust control should be developed. *N. septemfasciata* and *L. m. migratorioides* are now under fairly satisfactory preventive control, but much survey and laboratory work remains to be done on *S. gregaria*.

[Mishchenko (L. L.).] **Мищенко (Л. Л.). New Data on harmful Central Asiatic Locusts and Grasshoppers.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **71** no. 4 pp. 789–792, 8 figs., 6 refs. Moscow, 1950.

With the extension of cultivation in Soviet Central Asia, largely the result of improved irrigation, there has been an increase in the number of Acridids that injure crop plants there, and in this paper the author gives lists of 23 species and subspecies in 15 genera not previously recorded as injurious, showing the crops that they have attacked and the districts concerned. Two new genera are erected, one for a new species, and 6 new species and subspecies are described, including one new species from northern Afghanistan.

Kennedy (J. S.). **A preliminary Analysis of Oviposition Behaviour by *Locusta* (Orthoptera, Acrididae) in Relation to Moisture.**—*Proc. R. ent. Soc. Lond.* (A) **24** pt. 7–9 pp. 83–89, 12 refs. London, 1949.

Previous work has shown that although a fairly high air humidity suffices to bring about maturation and even initiate the oviposition process in locusts [*R.A.E.*, A **24** 228], the completion of egg-laying requires either the texture or the humidity of moist sand [**22** 262]. In order to obtain further information on the effects of air and soil moisture on oviposition, laboratory experiments were carried out with mature females of *Locusta migratoria migratorioides* (R. & F.) phase *transiens* in cages provided with sand in tubes, each 4 ins. long and $1\frac{1}{4}$ ins. in diameter, the tops of which were level with a false floor of perforated zinc under which was a layer of moist sand that kept the relative humidity at 50–80 per cent. The moisture content of the sand in the tubes was varied, and it was found that the locusts began digging in dry sand as frequently as in sand that was moist or sodden, but often abandoned the holes in dry sand ; holes made in sodden sand tended to lose their shape and become partially filled in. No egg pods were deposited in dry sand, and the number laid was reduced when the sand was sodden. When the sand was moistened with medicinal paraffin instead of water, full-length holes were made, but no eggs were deposited. Probing the substrate with the abdomen, which is the first stage in oviposition, took place in various soft materials, regardless of their water content or texture, and was not induced solely by high air humidity ; it was continued when the locusts were transferred to a cage with a metal floor. It therefore appears that the initiation of digging depends on the presence of soft soil, its completion occurs most frequently when the soil is moist but not sodden, and the completion of egg-laying requires soil moistened with water.

Appel (O.). Ed. **Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten.** [Plant Protection. The Prevention and Control of Plant Pests and Diseases.]—Sorauer (P.). *Handb. Pflanzenkr.* **6** [I. Halbband] 2. neubearb. Aufl., 1. Lief., xv+448 pp., 3 graphs, many refs. Berlin, P. Parey, 1952. Price *DM.* 78.

The sixth volume of Sorauer's text-book deals with plant protection and is divided into two half-volumes [*cf. R.A.E.*, A **32** 188, etc.]. A new edition of the first half-volume is in course of preparation and is to consist of two parts, each with its own index, of which this is the first. It comprises the sections down to quarantines of the earlier edition [*cf.* **25** 262–263]. The matter has

been brought up to date, and the section on soil disinfection has been rewritten and expanded by the inclusion of many new chemicals.

RECKENDORFER (P.). **Ein Beitrag zur Analytik der Phosphorsäureester. I. Teil : Der reine Wirkstoff.** [A Contribution to the Analysis of Phosphoric Acid Esters. Part I. The pure Substance.]—*Pflanzenschutzberichte* **5** pt. 5–6 pp. 287–296, 2 pls., 1 fig., 18 refs. Vienna, 1950. (With a Summary in English.)

As parathion and methyl-parathion are now widely used as insecticides, the author applied well-known analytical methods for the determination of sulphur, phosphorus and alkoxyl groups to pure samples of these compounds. He compares the results with the calculated equivalents in tables and shows that the methods adopted afforded a high degree of accuracy.

YORK (G. T.) & PRESCOTT (H. W.). **Nemestrinid Parasites of Grasshoppers.**—*J. econ. Ent.* **45** no. 1 pp. 5–10, 2 figs., 13 refs. Menasha, Wis., 1952.

In the course of investigations on grasshoppers on range land in Montana in 1949–50, observations were made on the Nemestrinid parasites, *Trichopsidea clausa* (O.-S.) and *Neorhynchocephalus sackeni* (Will.), which were common in some areas. In most places, adults of the two parasites were present in about equal numbers, but in one, where *Metator pardalinus* (Sauss.) comprised 95 per cent. of the grasshopper population, only *T. clausa* was found.

The life-histories and habits of the two species were found to be very similar. In 1950, the first adults of *T. clausa* were observed on 13th June, when early grasshoppers had reached the first and second instars, but only a few males were seen. Females were abundant and ovipositing on 20th June, and adults were present until the end of August in some districts. They were not observed to feed and survived for only a day or two in cages. Eggs were deposited in cracks and in holes left by wood-boring beetles in wooden posts or trees. One female laid over 1,000 eggs in 12–15 minutes, and another 4,700 in seven hours. The larvae hatched in a few days and were probably scattered by the wind soon after. Their mode of entering the host is not known, but observations suggested that they penetrate the connective tissue between the sclerites. They fed first on the ovaries or testes of the grasshoppers and then on other body tissues, and prevented the full development of any eggs in the female hosts. Only one living larva was found in any host. Full-fed larvae forced their way through the body wall of the grasshoppers and entered the soil almost immediately, where they overwintered an inch or two below the surface. They pupated in spring, and the pupal stage lasted several weeks. There is one generation a year. It is not known whether larvae of *N. sackeni* are as effective as those of *T. clausa* in preventing reproduction of the host.

In Montana, *T. clausa* was reared from *M. pardalinus* and *Arphia pseudonietana* (Thos.), and *N. sackeni* from *Encoptolophus sordidus costalis* (Scud.) and four species of *Melanoplus*, and dissections showed that grasshoppers of eight other species were parasitised by one or other of the Nemestrinids. The percentage parasitism varied with the year, locality and species of grasshopper. It was highest in 1950, when about 50 per cent. of females of *Metator pardalinus* were parasitised by *T. clausa* in August in one locality and 50 per cent. *Camnula pellucida* (Scud.) by unidentified species in another. On 26th September, near Bozeman, 5 and 11 per cent., respectively, of females of *Melanoplus mexicanus* (Sauss.) and *M. dawsoni* (Scud.) were parasitised by *N. sackeni*.

SIMKOVER (H. G.) & SHENEFELT (R. D.). **Phytotoxicity of some Insecticides to Coniferous Seedlings with particular Reference to Benzene Hexachloride.**—*J. econ. Ent.* **45** no. 1 pp. 11–15, 3 figs., 11 refs. Menasha, Wis , 1952.

Chlordan and BHC (benzene hexachloride) have given promising results as soil insecticides against white grubs [*Lachnosterna* and related Lamellicorns] in forest-tree nurseries in Wisconsin [*cf. R.A.E.*, A **39** 340], and these and other compounds that gave effective control were tested for phytotoxicity. In laboratory tests, DDT, toxaphene, S(1,2-dicarbethoxyethyl) O,O-dimethyl dithiophosphate, dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene], parathion, DDD (TDE) [dichlorodiphenyldichloroethane], a 2 : 1 mixture of 1,1-bis(p-chlorophenyl)-2-nitrobutane and the corresponding propane, chlordan and heptachlor [1(or 3a),4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene] at 10 parts per million in aqueous solution proved relatively non-injurious to pine-root growth, but crude BHC (benzene hexachloride) and lindane [at least 99 per cent. γ BHC] induced root abnormalities, and detailed investigations were therefore made to discover the components responsible.

The anatomical and cytological abnormalities induced in the roots of Norway pine [*Pinus resinosa*] by BHC are described. It injured the roots when mixed with white sand at more than 8 oz. γ isomer per acre or with Plainfield sand at 1 lb. per acre. Greater root growth was obtained in white sand containing BHC at 2 and 4 oz. γ isomer per acre than at higher or lower rates. When seedlings of *P. resinosa* were exposed to solutions containing 1 p.p.m. BHC, growth was suppressed. When the pure α, β, γ and δ isomers were mixed with white sand at 1 lb. per acre, there was slight reduction in root weight and length, but no evidence that any isomer was definitely phytotoxic, and even tissue treated with the pure γ isomer was normal. Exposure of freshly germinated seedlings to suspensions of the purified isomers for seven days showed that all were phytotoxic at 100 p.p.m., but only the δ isomer caused definite inhibition of root growth and distinct root thickening at lower concentrations. BHC breaks down under alkaline conditions to produce a mixture of trichlorobenzenes, and this crude mixture and three of its known trichlorobenzene components in liquid all inhibited root growth. The most injurious was 1,3,5-trichlorobenzene and the least the 1,2,3 isomer ; the 1,2,4 isomer was intermediate in effect. Heptachlorocyclohexane and octachlorocyclohexane, impurities found in crude BHC, inhibited pine root growth less than crude BHC itself ; the second was the more toxic. Tests of the effect of vapours on the germination and growth of the seedlings showed that all the trichlorobenzene isomers were active, but that octachlorocyclohexane was the only impurity to cause root injury. The vapour of crude BHC inhibited root growth and produced typical clubbed roots in several of the seedlings, but none of the materials tested inhibited germination.

The particle size and pH of the soil had little effect on the capacity of BHC to induce root malformations in *P. resinosa*, but when peat was added to white sand at 25 per cent. by volume (2·4 per cent. organic matter on a dry-weight basis), BHC was no longer injurious at 1 lb. γ isomer per acre. The mineral ash, ether and hot-water extracts and extract residues of peat did not prevent injury or reduce the rate of development of abnormalities. No materials tested as chemical inhibitors of BHC injury, with the possible exception of biotin, overcame the undesirable effects of BHC on the roots. No root injury or depression of vigour was detected in seedlings of *P. resinosa* grown in Plainfield sand containing 100 lb. chlordan per acre, and 50 lb. chlordan per acre appeared to be beneficial to growth.

Most of 20 species of conifers exposed to soil treated with BHC at 1 lb. γ isomer per acre showed root malformations, but they differed in degree of

susceptibility. None was affected by chlordan at 10 lb. per acre, but black locust [*Robinia pseudacacia*] showed slight depression of vigour eight weeks after planting.

FIFE (L. C.), BONDY (F. F.) & WALKER (R. L.). **Spray versus Dust for Boll Weevil Control with Ground Equipment.**—*J. econ. Ent.* **45** no. 1 pp. 16–19. Menasha, Wis., 1952.

Tests were made at Florence, South Carolina, in 1949 to compare concentrated emulsion sprays and dusts applied with ground equipment against *Anthonomus grandis* Boh. on cotton. Emulsion concentrates were diluted with water to the desired strength and commercial dusts with pyrophyllite if necessary. Except where otherwise stated, 6–7 applications were made at about five-day intervals between 14th June and 1st August. Sprays were applied at about 9 U.S. gals. per acre between 9 a.m. and 5 p.m., regardless of wind velocity, and dusts at about 11 lb. per acre on the same dates between 5 and 7 a.m. when the plants were wet with dew and the air fairly calm. The rates of application of a given toxicant were about the same in dusts and sprays. Infestation records, made weekly until the crop was mature, showed that all materials gave good control of the weevil ; other insects and mites were not sufficiently numerous to affect the results. The gains in yield of seed cotton per acre averaged 383 and 448 lb. for toxaphene dusts and sprays, respectively, at about 2·2 lb. active ingredient per acre per application, 514 and 410 lb. for sprays and dusts of toxaphene with DDT applied at 2·2–2·4 lb. technical toxaphene and 1·09–1·2 lb. DDT per acre, 376 and 243 lb. for sprays and dusts of chlordan with DDT at 1·1 lb. chlordan and 0·55 lb. DDT per acre, and 460 and 544 lb. for sprays and dusts of BHC (benzene hexachloride) with DDT at 0·33 lb. γ BHC and 0·54 lb. DDT per acre. Applications of dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] were begun when 30 per cent. of the squares were infested, and eight were made between 28th June and 1st August, sprays being applied at 0·15 lb. active ingredient per acre per application and dusts at 0·172 lb. The seasonal square infestation was reduced from 57 to 13 and 9 per cent., respectively, and the yield increased by 1,122 and 835 lb. per acre. Aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonapthalene] was applied as a spray only, at 0·55 lb. active ingredient per acre per application, and it reduced the seasonal infestation from 43 to 10 per cent. and increased the yield by 434 lb. per acre.

None of the treatments caused commercial injury to cotton plants, and it is concluded that when weevil control, cost of materials and equipment and the possibility of combining spray applications with tractor cultivation are considered, low-gallonage spraying shows excellent promise.

ROTH (L. M.) & WILLIS (E. R.). **Observations on the Behavior of the Webbing Clothes Moth.**—*J. econ. Ent.* **45** no. 1 pp. 20–25, 1 fig., 29 refs. Menasha, Wis., 1952.

The following is based on the authors' summary. Observations on adults of *Tineola bisselliella* (Humm.) showed that the females give off a scent from the abdomen that attracts the males and induces courtship behaviour in them. The distance over which the scent from a single isolated female abdomen attracts the males is about 1·5 cm., but the distance can be increased by increasing the number of female abdomens used as a source of the attractant. When unfertilised females are kept on sheets of filter paper, the sex-attractant is imparted to the paper and can be extracted with petroleum ether. The crude extract can be kept for as long as a year at refrigerator temperatures without losing its ability to attract and activate male moths.

SUN (Yun-pei) & SUN (Jung-yi Tung). **Microbioassay of Insecticides, with special Reference to Aldrin and Dieldrin.**—*J. econ. Ent.* **45** no. 1 pp. 26–37, 16 refs. Menasha, Wis., 1952.

The authors deduce from previous work [*R.A.E.*, A **38** 426] the principle that deposits containing the same amounts of the same toxicant and the same quantity and quality of extracted substances should give the same mortality of insects of the same species, and show how it can be applied to the microbioassay of insecticides in extracts from plant or animal tissue or other materials. They describe the general procedure for carrying out such tests and compare different methods of evaluating results. The procedure involves taking untreated (standard) samples for comparison, and solutions for bioassay should be prepared by the simplest possible methods, since microscopic quantities of toxicants in animal and plant tissue may be partly lost or destroyed in protracted processes.

Details are given of four modifications of a microbioassay method in which house-flies [*Musca domestica* L.] are exposed to dried deposits. To ascertain whether an insecticide is present in a sample, even in amounts too low to cause moderate mortality, solutions containing the same amount of extracted material from treated and standard samples are put into jars, with the addition of three suitable doses of the toxicant, and the jars are rotated until the solvent evaporates, to mix the solutions and distribute them uniformly. Day-old flies are put in the jar about 15 minutes later, allowed to feed on milk absorbed on cotton-wool and kept at a temperature of 80°F. until mortality reaches 20–80 per cent., when the results are analysed by a ranking method for grouped data [**35** 265]. To determine traces of insecticide quantitatively, mortality is plotted against the added dosages of insecticide on log-probit paper for treated and standard samples, and the original amount of toxicant in the quantity of extract used per jar is found by subtracting the median lethal dosage shown for treated material from that of the standard sample. In an interpolation method for evaluating moderate quantities of insecticide from the same curves, the dosage producing the same mortality on the standard curve as each added dosage on that for the treated sample is found, and the average of the differences between the two sets of figures is taken as the original amount of insecticide per jar. If the extract contains larger amounts of toxicant, a preliminary test is necessary to determine its range of toxicity, and smaller volumes or more dilute solutions are used for preparing deposits in the jars, so that the dosages are suitable for comparison by the interpolation method. If the toxicant is very volatile, additional residue or other material may be added to retain it by sorption. Examples are given of the use of each method for the microbioassay of extracts containing aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] or dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene]. The first two were successfully used for samples of plant material or animal tissue, the third for soil and olive oil and the fourth for samples of fat from animals that ingested heavy doses of toxicants.

The sensitivity of the microbioassay methods varies with the toxicity of the insecticides, the susceptibility of the test insects, the amount of material extracted, the final volume of the extract, the volume of it in each jar, the quality and quantity of interfering substances in it, the length of time for which the insects are in contact with the toxic residues and probably other factors. If an extract does not kill the test insects, sublethal amounts of insecticide may be present, and these can be measured by adding a suitable quantity of the same insecticide before bioassay. It is suggested that the sensitivity of the residue method, defined as the minimum amount of a toxicant that can be significantly detected in extracts, expressed as parts per

million in the original sample, can be calculated from the equation, Sensitivity $= \pm DF/RV$, where D is the median lethal dosage on a standard curve, expressed as mmg. toxicant per jar, F a factor of accuracy that may vary from 0·2 to 0·1 depending on the number of replicates and the degree of variation of the results, R the number of grams of a sample per ml. final extract, and V the volume of treated extract per jar in ml. The same equation can be used to calculate the approximate size of sample necessary for a given sensitivity.

Interference caused by either extracted materials or contamination may upset the final results. In tests of more than 30 different plant and animal extracts, only orange oil was toxic to *M. domestica*, and this can be removed by evaporation. Amounts of different insecticides in a mixture cannot be distinguished by microbioassay methods, but in experimental work, only one insecticide is usually applied at a time, and under practical conditions, the toxicity of the combined residues from a mixture of different insecticides can be determined by bioassay when the quantities of each present are too small for chemical determination.

HUDDLE (H. B.) & MILLS (A. P.). **The Toxicity of Cedar Oil Vapor to Clothes Moths.**—*J. econ. Ent.* **45** no. 1 pp. 40–43, 11 refs. Menasha, Wis., 1952.

The following is based on the authors' introduction and summary. Previous workers have shown that the vapour of the oil of red cedar (*Juniperus virginiana*) is to some extent toxic to larvae of *Tineola bisselliella* (Humm.) [*cf. R.A.E.*, A **23** 474; **24** 125], and the relation between concentration of vapour, duration of exposure and percentage kill was investigated for larvae in the second half of their development.

The concentration of cedar-oil vapour in a cedar chest has been found to range up to 0·6 mg. per litre, and the results of the tests recorded indicate that exposure to this concentration for one week gives an average of 91 per cent. mortality of half-grown larvae. The period of exposure in a chest might be considerably longer in practice, and this would probably increase the mortality or decrease the concentration necessary to produce the same mortality. It is shown that concentrations of 1–2 mg. per litre are quite effective for exposures of 8–24 hours, and these concentrations can be produced in a clothes cupboard by means of a vaporiser improvised from an electric hair dryer in a manner described. It is concluded that although the work indicated considerable toxicity under the conditions tested, the results should not be used to predict the effect of higher concentrations and longer exposures.

MCGREGOR (S. E.) & TODD (F. E.). **Cantaloup Production with Honey Bees.**—*J. econ. Ent.* **45** no. 1 pp. 43–47, 4 refs. Menasha, Wis., 1952.

It has been shown that commercial production of cantaloupe melons without the aid of pollinating insects is impossible, and in an experiment in 1950 in the Salt River Valley of Arizona, honey bees were the only effective pollinators, thrips, beetles and native bees proving of no value. When colonies of honey bees were caged with flowering cantaloupe plants, production was increased, the fruits were set nearer the crown of the plant, and they were sweeter and larger and had more seeds than those in open plots. Insecticides may cause more damage by killing bees than the harmful insects they control, and they should be applied only if necessary and preferably before the melons flower. The materials least toxic to bees should be used, the applications should be at the lowest effective rate and made between 6 p.m. and 7 a.m., and drift of insecticides to plants attractive to bees should be prevented.

STEINHAUS (E. A.). **Microbial Infections in European Corn Borer Larvae held in the Laboratory.**—*J. econ. Ent.* **45** no. 1 pp. 48–51, 7 refs. Menasha, Wis., 1952.

The following is substantially the author's summary. A study of the causes of death of 274 larvae of *Pyrausta nubilalis* (Hb.) that died of disease in the laboratories of the United States Department of Agriculture in Ohio and Iowa showed that death was due to fungi, protozoa or bacteria or to combinations of these organisms. The principal fungus involved was *Beauveria bassiana*, the protozoa were mainly *Perezia pyraustae*, and bacteria of the genera *Pseudomonas*, *Alcaligenes* and probably *Achromobacter* were isolated. No larvae infected with *Beauveria* were found in samples collected in the field and kept in sterile vials, but the other types of infection were found occasionally in field-collected larvae. Laboratory handling appeared to increase the incidence of all forms of infection.

PANKASKIE (J. E.), FOUNTAINE (F. C.) & DAHM (P. A.). **The Degradation and Detoxication of Parathion in Dairy Cows.**—*J. econ. Ent.* **45** no. 1 pp. 51–60, 31 refs. Menasha, Wis., 1952.

In the first of two further experiments [*cf. R.A.E.*, A **40** 41], five cows in mid-lactation ingested parathion with their food at an average daily rate of 0·33 mg. per kg. body weight for 61 days, and no adverse effect on their milk production, weight or general health was observed. Throughout the experiment, no parathion or free p-nitrophenol was found in samples of their milk, jugular blood or urine, and no free p-aminophenol in their urine. In the second experiment, parathion as a commercial wettable powder was fed in capsules to a cow at rates increasing from 1 to 32 mg. parathion per kg. body weight per day over a period of 14 weeks. Examination of samples of its milk, blood and urine again showed no parathion, free p-nitrophenol or free p-aminophenol and indicated that the parathion must be hydrolysed *in vivo* to p-nitrophenol, reduced to p-aminophenol, conjugated with glucuronic acid to an appreciable extent and then excreted in the urine as p-aminophenylglucuronide. The fate of the thiophosphoric acid portion of the parathion molecule was not determined.

ASQUITH (D.) & KANE (N. F.). **Mite Control with concentrated Acaricides.**—*J. econ. Ent.* **45** no. 1 pp. 60–65. Menasha, Wis., 1952.

Experiments on the effectiveness of petroleum oil and various proprietary acaricides in concentrated-spray schedules against mites on apple were carried out in two orchards in southern Pennsylvania in 1951. The mites present on the trees were the European red mite [*Paratetranychus pilosus* (C. & F.)], the schoenei mite [*Tetranychus schoenei* McG.] and the two-spotted mite [*T. bimaculatus* Harvey]. The acaricides were applied by a speed sprayer or mist machines at three times the concentrations used in dilute sprays, and the trees also received standard insecticides and fungicides. All spray quantities are given per 100 U.S. gals.

In the first orchard, plots that were not given dormant treatments received a petal-fall spray on 16th May and up to five cover sprays, on 23rd May, 4th and 18th June, 2nd July and 2nd August. Very effective control was given throughout the season by the complete schedule, with 15 per cent. wettable parathion and an activated carbon at 3 lb. each in the first two applications and at 2·25 lb. in the last four, though there was some russeting of the fruits. There was no definite advantage in substituting a high-pressure pump for the standard low-pressure equipment on the speed sprayer. When the second and third cover sprays were omitted, four applications of 1·5 lb. each of 27 per cent. ethyl p-nitrophenyl thionobenzenephosphonate and the activated carbon

proved almost as effective as the complete parathion schedule, but had a less persistent effect than two of 1·5 lb. each of 15 per cent. parathion and carbon followed by two of 6 lb. Aramite 15-W (15 per cent. wettable 2-chloroethyl 2-(p-tert.butylphenoxy)-1-methylethyl sulphite) or four of Aramite at 3 lb. in the first two and 6 lb. in the others, which were equal in effectiveness, though the latter caused severe russeting of the fruits. Effective control through the season was also given by four sprays of 24 fl. oz. Metacide emulsion concentrate (6·2 per cent. parathion, 24·5 per cent. methylparathion and 2·7 per cent. related organic phosphates), which reduced the vigour of the trees and caused severe russeting of the fruits, and by two of parathion followed by two of 6 lb. wettable Sulphenone (25 per cent. p-chlorophenyl phenyl sulphone and 15 per cent. related aromatic sulphones). Four sprays of parathion were inferior. The best of these reduced schedules were quite as effective as others comprising a dormant spray of sodium dinitro-o-cresylate and petroleum oil, a delayed dormant spray of oil and bordeaux mixture, a fourth cover spray of parathion and activated carbon and a fifth of Aramite with ferbam [ferric dimethyl dithiocarbamate] or bordeaux mixture; the dinitro compound and oil effectively controlled the green apple Aphid [*Aphis pomi* Deg.] and the rosy apple Aphid [*Anuraphis roseus* Baker].

In the second orchard, sprays were applied on 26th June and 10th and 30th July. Aramite emulsion concentrate (4·8 lb. of the sulphite per U.S. gal.) at 24 fl. oz. in all sprays and the Aramite wettable powder at 4·5 lb. in the first and 6 lb. in the others were the most effective, followed by p-chlorophenyl p-chlorobenzenesulphonate at 3 lb. 50 per cent. wettable powder, S-(1,2-dicarbethoxyethyl) O,O-dimethyl dithiophosphate, at 3 U.S. pints 50·3 per cent. emulsion concentrate in the first two and 6 lb. 25 per cent. wettable powder in the third, 63·3 per cent. schradan (octamethyl pyrophosphoramide) at 24 fl. oz. in the first two and 1 U.S. pint in the third, and 50 per cent. 2,4-dichlorophenyl benzenesulphonate emulsion at 24 fl. oz. in the first two and 3 U.S. pints in the third, in that order. The dithiophosphate was the quickest in action, and of all the materials tested in both experiments, only this and Metacide emulsion prevented the increase of the woolly apple Aphid [*Eriosoma lanigerum* (Hsm.)].

Dickson (R. C.), Barnes (M. M.) & Turzan (C. L.). **Continuous Rearing of the Codling Moth.**—*J. econ. Ent.* **45** no. 1 pp. 66–68, 2 figs., 4 refs. Menasha, Wis., 1952.

The authors describe a laboratory method for continuous rearing of *Cydia* (*Carpocapsa*) *pomonella* (L.) by which a supply of all stages can be obtained at all seasons. Moths reared from larvae that have spun their cocoons in bands on tree trunks are normally used as the source of the stock. Moths are collected in the laboratory by a suction device that is described, and transferred to cylindrical celluloid cages 6 ins. in diameter and 11 ins. long lined with waxed paper, on which the eggs are laid. Most eggs per moth are obtained when the cages contain about 100 moths each and are exposed to natural evening twilight, a west window or a greenhouse proving quite satisfactory. Decreasing artificial light was less effective. The egg sheets can be changed each day, but changing them less frequently results in higher production. The eggs, on pieces of the waxed paper, are transferred to trays containing apples removed from the trees during thinning, which can be kept in cold storage until needed, and strips of corrugated paper. The trays are covered with 28-mesh brass strainer cloth and kept at 84°F. and about 35 per cent. relative humidity. Larval feeding is completed in about 18 days, and the larvae spin their cocoons in the corrugated paper, after which the covers are removed from the trays to allow the moths to emerge into glass-topped sleeve cages. The life-cycle lasts

about 28 days. To prevent diapause, all daylight is excluded from the room in which the larvae are reared and tungsten-filament lights are kept burning continuously [*cf. R.A.E.*, A **39** 441] ; illumination at the surface of the apples is about three foot-candles. Egg production is usually lower in winter than in summer, and an average of 20 eggs per female is considered satisfactory. About 60 per cent. of the eggs are viable ; 600 are transferred to each tray of 130 apples, and give rise to about 60 moths.

The same method has been used for continuous rearing of *Cydia* (*Grapholitha*) *molesta* (Busck), but it is desirable to perforate the skin of the apples to facilitate the entry of the larvae. *C. molesta* is much easier to rear than *C. pomonella*, chiefly because the moths oviposit more readily and the larvae do not attack one another.

WHITCOMB (W. D.). **A cooperative Test to evaluate Methoxychlor for Control of Plum Curculio on Apples.**—*J. econ. Ent.* **45** no. 1 pp. 68–72, 2 refs. Menasha, Wis., 1952.

The plum curculio [*Conotrachelus nenuphar* (Hbst.)] is an important pest of apple in New England and eastern New York. The period of greatest activity normally begins at the petal-fall stage of McIntosh apples and continues for about three weeks, and the calyx spray is the first application recommended for control. Since lead arsenate, which has so far been the standard material used, has recently afforded insufficient protection, a large-scale test was carried out in 1951 in which methoxy-DDT (methoxychlor), which had given good results in preliminary work, was tested in comparison with it. Essentially the same sprays were applied in two localities in Connecticut, two in Massachusetts and one each in New York, Rhode Island, Vermont and New Hampshire, timed according to local conditions. A calyx and two cover sprays were applied in all localities but New Haven, Connecticut, where the first cover spray was omitted, and suitable fungicides were included. The apparatus used varied. Infestation was very heavy, and the damage was considerable where only fungicides were applied. Sprays containing 3 lb. 50 per cent. methoxy-DDT wettable powder or 2 lb. with 2 lb. lead arsenate per 100 U.S. gals. gave about 97 per cent. reduction in the numbers of damaged apples, with no significant difference between them, whereas lead arsenate at 3–4 lb. per 100 U.S. gals. gave about 93 per cent. It is pointed out that practical recommendations based on the results of these tests should be governed by the cost and availability of the insecticides and their compatibility with other materials used.

DORMAL (S.), FREAR (D. E. H.) & DILLS (L. E.). **Chlorinated Nicotine Derivatives as Insecticides.**—*J. econ. Ent.* **45** no. 1 pp. 73–75, 6 refs. Menasha, Wis., 1952.

The authors describe the preparation of chlorinated derivatives from nicotine, nicotine monohydrochloride and nicotine dihydrochloride and the physical and chemical properties of 12 compounds so formed. When sprays containing them were tested against *Aphis fabae* Scop. (*rumicis*, auct.), they all showed the same general degree of toxicity. This was slightly less than that of nicotine monohydrochloride or dihydrochloride, which themselves tended to be rather less toxic than nicotine sulphate. All comparisons were made on the basis of actual nicotine content.

MISTRIC jr. (W. J.) & RAINWATER (C. F.). **Comparative Susceptibility of *Septanychus texazona* and *Tetranychus bimaculatus* to certain Sulfur and Phosphorus Products.**—*J. econ. Ent.* **45** no. 1 pp. 76–79, 10 refs. Menasha, Wis., 1952.

The following is based on the authors' introduction and summary. Outbreaks of spider mites have sometimes followed the use of organic insecticides on cotton in the United States, presumably because of the destruction of their natural enemies, and it has proved impossible to incorporate sufficient elemental sulphur for their control into the low-volume sprays recently introduced against cotton insects. An intensive search is therefore being made for acaricides that can be used in these sprays.

Laboratory tests were made at College Station, Texas, in the spring of 1950 to compare Aramite (which contains 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite), R-242 (which contains p-chlorophenyl phenyl sulphone), parathion and Merthon (which contains mercurated pentaethyl triphosphate and related phosphates) in emulsion sprays against *Septanychus texazona* McG. and *Tetranychus bimaculatus* Harvey on cotton seedlings. Adults of *S. texazona* were significantly more susceptible than those of *T. bimaculatus* to all the materials, but in tests with the eggs and immature stages, *S. texazona* was more susceptible than *T. bimaculatus* to Aramite and R-242, the two species were equally susceptible to parathion, and *T. bimaculatus* was significantly more susceptible than *S. texazona* to Merthon. Parathion was highly effective and Aramite effective against adults of *S. texazona*, but Aramite compared favourably with parathion for the control of an entire population of this mite. Parathion effectively controlled an entire population of *T. bimaculatus*.

SINCLAIR (W. B.) & CRANDALL (P. R.). **Determination of Ethylene Dibromide in Liquid and Gas Phases by the Use of Monoethanolamine.**—*J. econ. Ent.* **45** no. 1 pp. 80–82, 5 refs. Menasha, Wis., 1952.

Experiments in which monoethanolamine was introduced into flasks containing ethylene dibromide as a liquid or a gas, the flasks were heated at 90°C. for 30 minutes and the resulting bromide was determined, showed that in both cases the monoethanolamine absorbed all the ethylene dibromide. In order to determine whether ethylene dibromide remained in the gaseous phase at room temperature and whether representative samples of the gas could be withdrawn from a fumatorium and absorbed by monoethanolamine for chemical analysis, a small fumatorium was constructed, in which known amounts of ethylene dibromide were vaporised and thoroughly mixed with the air. Samples of gas were drawn from the bottom of the fumatorium and replaced by air entering at the top, and these were heated with monoethanolamine as before. The results showed that almost all the ethylene dibromide was recovered from the samples.

ASHDOWN (D.), DAHMS (R. G.), RIDGWAY (W. O.) & STILES (C. F.). **Hazards in the Use of Parathion for Greenbug Control.**—*J. econ. Ent.* **45** no. 1 pp. 82–84. Menasha, Wis., 1952.

An outbreak of *Toxoptera graminum* (Rond.) in the early spring of 1950, which threatened to destroy the winter-wheat crop over a large part of Oklahoma, was treated largely by applications of emulsifiable parathion sprays by aeroplane or with low-capacity sprayers suitable for the application of concentrates from the ground [*cf. R.A.E.*, A **40** 110]. An even more extensive control programme was followed in 1951, when spraying with parathion was carried out in March–May. It is estimated that about 270 people handled parathion in connection with aircraft application and 110 in connection with commercial

ground applications, and many growers applied parathion on a non-commercial basis. There was one case of fatal poisoning among these people in each year, and in 1950 there were three cases of severe poisoning requiring hospital treatment and many of slighter poisoning.

Details are given of the circumstances in which poisoning occurred. The serious incidents resulted from repeated handling of parathion rather than from initial contact [*cf.* **39** 306], and each case discussed involved many violations of the recognised precautions. Shoes appeared to be an important source of parathion intake, and many used containers were later seen in use on farms. Additional precautions considered desirable are briefly discussed.

The only deaths among animals were those of a dog that persisted in chasing an aeroplane used to apply parathion and was often in the direct path of the spray and of a cow in calf that had been on dry feed but grazed in a field three days after parathion had been applied.

CLANCY (D. W.), MARUCCI (P. E.) & DRESNER (E.). **Importation of natural Enemies to control the Oriental Fruit Fly in Hawaii.**—*J. econ. Ent.* **45** no. 1 pp. 85–90, 7 refs. Menasha, Wis., 1952.

An account is given of the work carried out in various parts of the world since 1947 on the discovery of parasites of fruit-flies that might prove suitable for liberation against *Dacus ferrugineus dorsalis* Hend. in Hawaii [*cf. R.A.E.*, A **40** 83, etc.]. Between June 1948, when it was organised on a co-operative basis, and September 1950, over two million fruit-fly puparia and 6,000 adult parasites were received in Honolulu from Malaya, Africa, India, Australia, New Caledonia, New Britain, Siam, the Philippines, Formosa, South China, Mexico and Saipan (Mariana Islands). The pupae were reared under strict quarantine conditions and gave rise to numerous species of fruit-flies and some 106,000 adult parasites of at least 40 species.

Many of the latter could not be propagated on *D. f. dorsalis*, but *Opius longicaudatus* (Ashm.), *O. incisi* Silv., *O. oophilus* Fullaway and a species of *Opius* of uncertain taxonomic status, which were imported from Malaya in 1948, became established and are showing great promise in the field [*cf.* **40** 83], and several others are being reared and released. These include *Trybliographa daci* Weld from Malaya, *O. kraussii* Fullaway, the Australian race of *Dirhinus giffardii* Silv., and a species of *Trybliographa* apparently identical with the Malayan *T. daci*, from Queensland, *Tetrastichus dacicida* Silv., from Kenya, the Indian race of *O. incisi*, which seemed more prolific than the one from Malaya, and *O. watersi* Fullaway, from northern India, and *O. formosanus* (Fullaway), which may be merely a biological race of *O. longicaudatus*, from Formosa.

WOODSIDE (A. M.). **Control of the Pear Borer in Apple Trees.**—*J. econ. Ent.* **45** no. 1 pp. 98–101, 1 ref. Menasha, Wis., 1952.

Larvae of *Thamnosphecia* (*Aegeria*) *pyri* (Harr.) cause severe damage to mature and ageing apple trees in Virginia. They bore in the bark and cambium and are present in the same positions year after year, as roughened bark is attractive to the ovipositing moths [*cf. R.A.E.*, A **9** 201]. Large cankers develop, usually on the lower surfaces of the larger branches, which die from the effects of partial girdling. The eggs are deposited singly in crevices or irregularities in the bark, and the larvae hatch in a week or less and burrow into the bark. There are two peaks of moth flight in Virginia, in late May and soon after the middle of June, and most of the eggs are laid at these times or soon after. Apparently about 70 per cent. of the larvae overwinter once and the remainder twice, development in these cases lasting about 13 and 20 months, respectively.

In tests of organic insecticides in 1950 and 1951, sprays were applied with a power sprayer from under the tree to the trunks and each main branch, as far up as the rough bark extended. Amounts are given per 100 U.S. gals. In 1950, sprays of DDT or parathion on 29th April had no effect on larvae already in the bark, but treatments during the flight periods were effective. One application of 3 lb. 25 per cent. wettable parathion on 25th May reduced the numbers of first- and second-year larvae present in the following September–October by 98 and 51 per cent., respectively, and one of 8 lb. 50 per cent. wettable DDT by 92 and 44 per cent. When treatment was applied on 13th June, the percentages were 99 and 90 for parathion and 89 and 47 for DDT. In 1951, two applications of 5 lb. 15 per cent. parathion, 3 lb. EPN 300 (25 per cent. ethyl p-nitrophenyl thionobenzenephosphonate) or 8 lb. DDT on 28th May and 15th June gave 99 per cent. reduction of first-year and 78, 68 and 61 per cent. of second-year larvae, the parathion treatment resulting in 82 per cent. reduction in moth emergence in July. Three applications of 2 lb. 15 per cent. parathion, one of 3 lb. 15 per cent. parathion or 2 lb. EPN 300 or two of 5 lb. 50 per cent. DDT, gave 95–98 per cent. reduction of first-year larvae, but less than 50 per cent. of second-year individuals. Trees receiving two applications of parathion or DDT in 1950 and one of the same material in 1951 showed 96 and 83 per cent. reduction in total infestation in October 1951, when trees that had been thoroughly scraped once in 1950 showed 80 per cent. reduction.

It is concluded that the addition of 2 lb. parathion to three sprays in the regular schedule, beginning at petal-fall, for two years in succession should effectively reduce a heavy infestation, provided that all the larger branches and the trunks of the trees are thoroughly wetted with spray.

Cox (J. A.). **A comparative Study of organic Insecticides for Control of Grape Berry Moth.**—*J. econ. Ent.* **45** no. 1 pp. 101–104, 4 refs. Menasha, Wis., 1952.

Although DDT has given outstanding control of *Polychrosis viteana* (Clem.) on vines, the problem of spray residues on the grapes has led to interest in other insecticides, and experiments with various proprietary materials were carried out in Pennsylvania in 1949–51. All spray quantities are given per 100 U.S. gals. In the main tests, the sprays were applied at 200–225 U.S. gals. per acre with a conventional sprayer and a covered, inverted, U-shaped boom carrying seven nozzles directed upwards on each side of the row, and except where otherwise indicated, concentrations throughout were those first mentioned.

In 1949, when infestation was heavy, sprays of 1·5 lb. 50 per cent. DDT or 1 lb. 25 per cent. parathion on 20th and 30th June and 27th July or of DDT on the first two dates and parathion on the third gave more than 97 per cent. reduction in infested grapes, and control by parathion was not materially improved by an additional application on 4th August. DDT on the first and third dates and 1·5 lb. 50 per cent. DDD (TDE) [1,1-bis(p-chlorophenyl)-2,2-dichloroethane] on the first three gave only 91–94 per cent. reduction. In 1950, when infestation was light, sprays of DDT on 30th June, 11th July and 16th August and of DDT on the first two dates and parathion on the last both gave 97 per cent. reduction, and DDT on the first date and parathion on the last two gave 99·2 per cent. In another vineyard, parathion applied on these three dates and 2 lb. 50 per cent. methoxy-DDT (methoxychlor) on the first two and on 23rd August gave more than 97 per cent. reduction, and were no more effective when used on all four dates. Methoxy-DDT on the first date followed by parathion on the second and third was equally effective, but 2 lb. 50 per cent. DDD on the first three less so. Of organic phosphates applied on 28th June, 7th July and 17th August, 1 U.S. pint Metacide emulsion

concentrate (33·4 per cent. of a 1 : 4 mixture of parathion and its methyl analogue) and 1 lb. 27 per cent. wettable ethyl p-nitrophenyl thionobenzenephosphonate (EPN-300) gave 95·7 and 98·3 per cent. reduction, and 2 lb. 25 per cent. wettable S-(1,2-dicarbethoxyethyl) O,O-dimethyl dithiophosphate, 1 U.S. pint of an emulsion concentrate containing 50 per cent. of this compound, 1·5 lb. 25 per cent. wettable fluoro-DDT (1,1-bis(p-fluorophenyl)-2,2,2-trichloroethane) or 2 lb. 50 per cent. ethyl-DDD (1,1-bis(p-ethylphenyl)-2,2-dichloroethane) only 77–91 per cent. Metacide injured the grapes and foliage. In 1951, when infestation was again heavy and sprays were applied on 25th June, 6th July and 10th August, DDT and 1 lb. 25 per cent. EPN-300 both gave more than 97 per cent. reduction and 1·5 lb. 15 per cent. parathion in three sprays and DDT or methoxy-DDT in two followed by the parathion in one, almost 97 per cent., but three of methoxy-DDT, 3 lb. 25 per cent. S-(1,2-dicarbethoxyethyl) O,O-dimethyl dithiophosphate or 3 lb. 25 per cent. ethyl-DDD were less effective.

In a subsidiary test of concentrated sprays, applied on 26th June, 7th July and 14th August 1951 with an air-blast sprayer delivering 1,200–1,400 cu. ft. air per minute, into which the insecticide was introduced at a pressure of 90 lb. per sq. in., 6 lb. 50 per cent. DDT paste or wettable powder, 8 lb. 50 per cent. methoxy-DDT and 6 lb. 15 per cent. parathion (all at 50–60 U.S. gals. spray per acre) and 6 lb. 75 per cent. DDT at 30–40 U.S. gals. per acre all gave more than 96·5 per cent. reduction of a rather less heavy infestation, but further tests will be necessary to estimate the value of such sprays.

EDEN (W. G.). **Control of Corn Earworm in Sweet Corn in Alabama.**—*J. econ. Ent.* **45** no. 1 pp. 105–108, 2 refs. Menasha, Wis., 1952.

The following is based on the author's summary. Experiments on the effectiveness of mineral-oil emulsions containing DDT for the control of *Heliothis armigera* (Hb.) on sweet maize were carried out in Alabama during 1950 and 1951. Three applications of sprays giving 10 or 20 lb. mineral oil with 2 lb. DDT per acre per application with a knapsack sprayer gave good control but reduced the total yield and caused some scorching of the foliage. The treatment did not affect the weight of the ears or the degree to which they were filled out at the tips. When applied at a pressure of 100 lb. with a high-clearance power-driven sprayer, the treatment caused no scorching or reduction in yield. There were no significant differences in control when the sprays were applied at 12·5, 25 or 50 U.S. gals. per acre, provided that the amount of toxicants per acre remained constant, or when fan or cone nozzles were used and when there were two or four fan-type nozzles per row, and the ground speed of the machinery had no effect on control when volumes and rates of application were the same. When only one harvest of sweet maize was made, as is customary in Alabama, four applications of spray were necessary for practical control. Reducing the quantity of DDT per acre reduced the degree of control, but reducing that of mineral oil or omitting it altogether had no effect.

CLANCY (D. W.) & POLLARD (H. N.). **The Effect of DDT on Mite and Predator Populations in Apple Orchards.**—*J. econ. Ent.* **45** no. 1 pp. 108–114, 4 graphs, 15 refs. Menasha, Wis., 1952.

The following is substantially the authors' summary of further observations in Virginia in 1948 [*cf. R.A.E.*, A **37** 433]. Populations of phytophagous mites and their natural enemies were sampled once a fortnight or once a month in 25 apple orchards to determine the effect on them of DDT sprays applied for the control of the codling moth [*Cydia pomonella* (L.)].

In orchards that were well cared for, DDT failed to stimulate outbreaks of *Paratetranychus pilosus* (C. & F.) more than did lead arsenate, possibly because of the depressing effect of sulphur fungicides on the dominant early-season predators in both plots, but late-summer populations of *Tetranychus bimaculatus* Harvey and *T. schoenei* McG. reached higher levels in the DDT plots than in those sprayed with lead arsenate. Although the Coccinellid, *Stethorus punctum* (Lec.), was the most important predator in these orchards, it was unable to afford control until the mites had become abundant enough to cause definite injury, regardless of the material used in the sprays. It was numerous in the DDT blocks during August and September, after residues had deteriorated, and mostly attacked *Tetranychus* spp. Other predators of less importance were *Iphidulus* spp., *Leptothrips mali* (Fitch), *Scolothrips sexmaculatus* (Perg.) [*cf.* **40** 136] and several Hemiptera, Chrysopids and Hemerobiids.

In neglected unsprayed orchards, *Stethorus* was largely replaced by *Iphidulus* and the predacious thrips, which kept populations of injurious mites at extremely low levels. When DDT sprays were applied to several of the trees, the predators were killed and infestations increased rapidly. *Iphidulus* is undoubtedly one of the most effective of the predators that attack phytophagous mites, particularly at low host densities, but it is unable to survive the sulphur and DDT sprays now used in commercial orchards, and long-term ecological studies are needed to show whether biological control can be improved by modifying existing spray practices.

Jefferson (R. N.) & Eads (C. O.). **Control of Sod Webworms in southern California.**—*J. econ. Ent.* **45** no. 1 pp. 114–118, 8 refs. Menasha, Wis., 1952.

Crambus sperryellus Klots and *C. bonifatellus* (Hulst) are the commonest insect pests of turf in southern California, and various insecticides were tested in sprays for control of the larvae in 1947–51. Preliminary experiments in 1947–48 showed that DDT, toxaphene and chlordan were all effective, with such prolonged toxicity that only one application per season might be necessary. In 1949, single applications of DDT, toxaphene and chlordan at 5 lb. per acre, aldrin [1,2,3,4,10,10 - hexachloro - 1,4,4a,5,8,8a - hexahydro - 1,4,5,8 - diendo - methanonaphthalene] at 2·5 lb. and dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] at 1·5 lb., all in wettable powders, between 29th June and 6th July eliminated the larvae by 19th–20th July. Some plots on heavily infested ground were again showing injury in early September, but additional applications on 6th September destroyed all larvae by the middle of the month. In other tests, treatment with DDT at about 2·5 lb. or more per acre, toxaphene at 4 lb. per acre or chlordan at 4·5 and 9 lb. per acre in June or July gave good control.

In 1950, applications of 4 and 6 lb. toxaphene and 8 lb. chlordan per acre in wettable-powder sprays on 20th July gave good control throughout the season, and in 1951 similar sprays of aldrin at 0·5, 0·6 and 1·2 lb. per acre on 12th July gave good immediate control, but had little residual effect at the two lower rates. DDT, toxaphene and chlordan in wettable-powder sprays and chlordan in an emulsion were generally effective when applied by hand equipment in 1949.

The most practical treatment for large areas appeared to be the application of 300–400 U.S. gals. spray containing 4–5 lb. actual DDT, chlordan or toxaphene or 1·5–2·5 lb. aldrin per acre. Dieldrin is promising but was tested in only one year. The number of applications required during a season depends on various factors, such as the type of grass, cultural practices or management, and the prevalence of the moths. No injurious effects on the grasses were

observed from any of the materials used, but toxaphene, which is apparently unstable in soil, is perhaps preferable where treatments are likely to be necessary every year.

WENE (G. P.) & WHITE (A. N.). **Toxicity of new Insecticides to Cabbage Aphides.**—*J. econ. Ent.* **45** no. 1 pp. 118–120, 1 fig., 3 refs. Menasha, Wis., 1952.

In view of a heavy infestation of *Brevicoryne brassicae* (L.) in the Lower Rio Grande Valley of Texas in 1950–51, which destroyed the cabbage crop and was not controlled by dusts or sprays of BHC (benzene hexachloride) or TEPP (tetraethyl pyrophosphate) applied from aeroplanes, preliminary experiments were carried out to evaluate recently developed insecticides against the Aphid. These comprised parathion Metacide (which contains 6·2 per cent. parathion, 24·5 per cent. methyl-parathion and 2·7 per cent. related organic phosphates), Systox (which consists of 32·1 per cent. trialkyl thiophosphate [O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate] and 67·9 per cent. emulsifier), G-22828 (a new material of unstated composition), Dilan (which consists of 8·33 per cent. 1,1-bis(p-chlorophenyl)-2-nitropropane, 16·67 per cent. 1,1-bis(p-chlorophenyl)-2-nitrobutane and 75 per cent. inactive ingredients), Potasan (which consists of 30·6 per cent. 4-methylumbelliferone O,O-diethyl thi phosphate (also known as diethyl or dieothxythiophosphoric acid ester of 7-hydroxy-4-methyl coumarin) and 69·4 per cent. inert ingredients), and schradan (octamethyl pyrophosphoramide). All spray quantities are given per 100 U.S. gals.

When applied at about 120 U.S. gals. per acre to cabbage heads 3 ins. in diameter in fields that had been abandoned owing to the heavy infestation, sprays containing 1 U.S. quart 20 per cent. TEPP, 0·25 lb. parathion, 0·38 lb. Metacide or 0·38 lb. Systox gave 94–99 per cent. reduction in population after two days, as compared with no treatment, and the last three 96–99 per cent. after four, when infestation was increasing in plots treated with TEPP, whereas sprays containing 1·6 lb. G-22828, 0·5 lb. Dilan or 0·25 lb. Potasan were less effective. In another test on similar plants, the percentages of reduction after 8 and (in brackets) 14 days were 85 (59) and 72 (27) for 0·25 and 0·13 lb. γ BHC, 84 (63) and 78 (52) for 0·25 and 0·13 lb. parathion, 84 (69) for 0·5 lb. schradan, and 99 (77) and 93 (74) for 0·38 and 0·19 lb. Systox, respectively. All materials gave more than 90 per cent. reduction in one day, and only Systox at 0·38 lb. was still effective after 21 days.

ARANT (F. S.). **Toxicity of Aldrin to Chickens.**—*J. econ. Ent.* **45** no. 1 p. 121, 2 refs. Menasha, Wis., 1952.

Experiments were carried out in 1950 to determine the acute and chronic toxic effects of aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] on chickens three and six weeks old. When single doses of 5–35 mg. per kg. body weight were administered in capsules, the results indicated that the median lethal dosage is between 10 and 15 mg. per kg. for both age groups, and when birds of both groups fed on mash containing 25, 50, 100 and 200 parts per million of aldrin, they died after periods inversely proportional to the amounts of aldrin in the mash, indicating that the upper limit of tolerance in the diet is below 25 p.p.m. The symptoms, which are described, were similar for acute and chronic doses, but appeared earlier after the former.

DUNAVAN (D.). **Insect Pollination of Ladino Clover in South Carolina.**—*J. econ. Ent.* **45** no. 1 pp. 124–125, 1 fig. Menasha, Wis., 1952.

In view of the extensive use of ladino clover [*Trifolium repens latum*] in pastures in the southern United States and the consequent demand for seed,

investigations on the insects responsible for pollination were begun in South Carolina in June 1950. Cages 4 ft. square and 3 ft. high were set up in an established pasture containing a good stand of ladino clover and used to exclude all pollinating insects or all but honey bees ; in the latter case, a hive with one opening into the cage and another to the outside was used. Counts of the numbers of seeds per sample of 50 heads showed that very little seed was produced when pollinating insects were entirely excluded, and more on caged plants visited only by honey bees than on open-pollinated ones. Honey bees were ten times as numerous as any of the other Hymenopterous pollinators ; the latter proved to be mainly small bumble bee workers.

MICHELBACHER (A., E.) MIDDLEKAUFF (W. W.) & BACON (O. G.). **Stink Bug Injury to Tomatoes in California.**—*J. econ. Ent.* **45** no. 1 p. 126, 1 fig., 3 refs. Menasha, Wis., 1952.

Injury to tomato fruits due to feeding by Pentatomids has occurred sporadically in California for many years, but was not important until 1951. In that year, considerable damage associated with *Thyanta custator* (F.) was observed at Woodland on 20th July. The bugs were more numerous than usual and had apparently moved into the tomato field from surrounding clover and lucerne seed fields. Serious damage was also observed in a field near Clarksburg, Sacramento County, on 26th August, when many green and ripe fruits were injured by *Euschistus conspersus* Uhl. in the half bordering a seed field of fescue [*Festuca*] that had been harvested at the beginning of July. All stages were abundant, and green tomatos were apparently the preferred food. Dusting with 30 lb. 10 per cent. toxaphene per acre from an aeroplane gave effective control of the nymphs and permitted a satisfactory harvest. The injury by the Pentatomids, which was very characteristic, is described ; where feeding on green fruits was not severe, there was a tendency to recovery.

SHELFORD (V. E.). **Termite Treatment with aqueous Solution of Chlordane.**—*J. econ. Ent.* **45** no. 1 p. 127, 2 refs. Menasha, Wis., 1952.

In further tests in 1950 of the soil near the foundations of a house in Illinois that had been treated with 1 per cent. chlordan against termites three years earlier [*cf. R.A.E.*, A **38** 251, 435], termites confined with samples taken at depths of 3–6 ins. within 0·5–2 ins. of the west, north and east sides of the house showed symptoms of paralysis after 1·3, 3·2 and 1·3–2 hours and all were dead in 4, 4 and 4–10 days, respectively. Paralysis was delayed in soil from the north side probably because less chlordan had been applied there. There was no evidence that the chlordan had deteriorated in the soil.

TURNER (H. F.) & EDEN (W. G.). **Toxicity of Chlordane to Chickens.**—*J. econ. Ent.* **45** no. 1 p. 130, 3 refs. Menasha, Wis., 1952.

In experiments in 1950 to determine the acute and chronic toxicity of chlordan to chickens three and six weeks old, groups of both ages were given single doses of 175–250 mg. per kg. body weight in capsules or allowed to feed for 12 weeks on rations containing 250, 500 or 1,000 parts per million of chlordan. The results of the first test showed that the median lethal dosage for both age groups was 220–230 mg. per kg. body weight. In the second, all birds that received 500 or 1,000 p.p.m. chlordan in the diet died before the end of the feeding period, after intervals inversely proportional to the amount of poison administered, but of those receiving 250 p.p.m. 1 of 14 younger chickens and 4 of 14 older ones survived. The mean weights of untreated birds and those receiving 250 p.p.m. chlordan for 12 weeks were 2,010 and 1,517 gm. in the younger group and 2,330 and 1,594 gm. in the older one. The symptoms of chlordan poisoning are described.

Knowlton (G. F.) & Tibbetts (T.). **The Brown Wheat Mite in Utah.**—*J. econ. Ent.* **45** no. 1 p. 130. Menasha, Wis., 1952.

Petrobia latens (Muller) [*cf. R.A.E.*, A **40** 116, etc.] caused substantial injury to many thousands of acres of dry-land wheat in four counties of Utah in 1951. In Salt Lake and Tooele Counties, injury became evident in early May and was severe in many fields by 20th May. Some were sprayed by aeroplane in early June with 1·5–2 U.S. pints 25 per cent. emulsifiable parathion per acre ; kills appeared to be highest when at least 4–5 U.S. gals. liquid per acre, containing 2 U.S. pints concentrate, was used.

In general, control was delayed too long in the dry fields and not attempted on irrigated land. The mite was numerous and associated with typical foliage discoloration on self-sown rye and dry-land wheat planted in autumn over most of the area examined in Salt Lake, Tooele and Juab Counties and was generally present in seven other counties, though damage was negligible or light. By 20th–22nd June, infestation and injury were still conspicuous on green foliage, though the wheat had begun to mature, and infestation was as severe on spring-planted fields of irrigated wheat, barley and oats in Salt Lake County as it had been earlier on dry-land wheat.

Cockerham (K. L.) & Harrison (P. K.). **New Sweetpotato Seedlings that appear resistant to Sweetpotato Weevil Attack.**—*J. econ. Ent.* **45** no. 1 p. 132. Menasha, Wis., 1952.

The results are given of further experiments in Louisiana confirming the resistance of the two most promising local sweet-potato seedlings (L 187 and L 244) to attack by *Cylas formicarius elegantulus* (Summers) [*cf. R.A.E.*, A **37** 160].

Cox (J. A.). **The European Earwig in Erie County, Pennsylvania.**—*J. econ. Ent.* **45** no. 1 p. 132. Menasha, Wis., 1952.

Forficula auricularia L. has been present in Erie County, Pennsylvania, for some years, and in July 1949, it was found round a house at North East. A survey in the summer of 1951 showed that the infestation had spread somewhat and that the earwigs were feeding on vegetables and flowers and causing annoyance in houses. One lawn in the infested area was treated with 4 lb. of a wettable powder containing 25 per cent. dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] per 100 U.S. gals., and no living earwigs were found on it four days later, though dead ones were numerous under débris ; on an untreated lawn, living earwigs were found under trash and in other hiding places.

Mundinger (F. G.) & Slate (G. L.). **Insecticide Sprays as a probable Control of "Sterility" in Blackberries.**—*J. econ. Ent.* **45** no. 1 pp. 135–136. Menasha, Wis., 1952.

Partial or complete failure of the fruits to set has for many years been observed on blackberries grown at Geneva, New York ; the plants blossom freely, but fruit development is arrested soon after flowering, and in some years a large proportion of the crop is lost. The fact that blossom-clusters covered for breeding purposes have seldom, if ever, shown this condition indicates that it was caused by insects. Spraying with 2 lb. DDT per 100 U.S. gals. on 10th May, 1951, about a week before the flowers opened, reduced the percentage of fruits injured at harvest on 23rd–24th July from 73 to 6 on one variety and from 62 to 6 on another, and similar treatment with 0·5 lb. dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] per 100 U.S. gals. reduced it from 47 to 2 and from 66 to 20 on two

others. It is not known what insect caused the condition, but it seems likely that the tarnished plant bug [*Lygus oblineatus* (Say)] was responsible. This Mirid was abundant on the plants at the time of treatment, and is known to injure the buds and fruits of many plants.

MITCHENER (A. V.). **Aldrin, DDT, Dieldrin and other Insecticides for Control of Imported Cabbageworm.**—*J. econ. Ent.* **45** no. 1 pp. 136–137, 1 ref. Menasha, Wis., 1952.

Pieris rapae (L.) is one of the most destructive insect pests of cabbage in Manitoba and was the only one present in serious numbers in 1951, when investigations were carried out on its control with DDT and some of the newer insecticides. Sprays prepared from emulsion concentrates diluted to contain 2 oz. actual aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene], dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene), Compound 711 (a stereoisomer of aldrin) or Compound 269 (a stereoisomer of dieldrin) or 6·66 oz. DDT per 40 gals. with a wetting agent, were applied at 100 gals. per acre on 3rd August, when the cabbage heads had just begun to form, and again on 28th August, and sample plants were examined for infestation at weekly intervals from 7th August until 10th September. The total numbers of larvae found on the 90 plants so examined in each series were 121 for DDT, 151 for Compound 269, 303 for Compound 711, 393 for dieldrin, 1,036 for aldrin, and 1,269 for no treatment. Populations increased on all plots until 27th August, but decreased to a marked degree on all but untreated plots and those receiving aldrin after the second application. On 6th October, when the cabbages were trimmed for market, those sprayed with Compound 269 were the largest, followed in order by those treated with Compound 711, DDT, dieldrin and aldrin. Neither trimmed heads nor outside leaves of cabbages treated with Compound 269 or DDT showed signs of insect feeding, trimmed heads from plants treated with Compound 711 were free from injury, but the outside leaves were damaged, and some of the cabbages treated with dieldrin or aldrin and most of the untreated ones were so damaged as to be unmarketable.

JEFFERSON (R. N.). **Insecticide Treatments for the Corn Earworm on certain Flower Crops.**—*J. econ. Ent.* **45** no. 1 pp. 137–138, 1 ref. Menasha, Wis., 1952.

Heliothis armigera (Hb.) occasionally causes serious losses in commercial plantings of flowering plants in California. In 1947, larvae attacking the maturing flower heads of *Gerbera jamesoni* grown for seed were identified as *H. armigera*, *Homoeosoma mucidellum* Rag. and *Platynota* sp., of which the first was the most numerous and probably responsible for most of the damage. Dusts containing 5 per cent. DDT, toxaphene or chlordan, applied at about 100 lb. per acre on 19th July, when the damage was first observed, and on 24th July and 6th August reduced the percentage of injured flower heads from 12·9 for no treatment to 5·3, 4·7 and 4·2, respectively, between 24th July and 5th August, and from 11·3 to 0·6, 0·9 and 0·6 between 6th and 27th August.

In 1949, when asters infested by leaf-miners were sprayed four times or dusted nine times between 29th August and 19th September, observations were made on the effect of the treatments on *Heliothis armigera*. Sprays containing 1 or 2 lb. actual chlordan or 1·25 lb. toxaphene in the form of emulsion concentrates, or BHC (benzene hexachloride) in a wettable powder to give 0·24 lb. γ isomer, per 100 U.S. gals. reduced the average number of damaged flowers per plot from 73·3 for no treatment to 1, 1·7, 4·3 and 14·7, and dusts containing 10 per cent. toxaphene and 0·75 per cent. γ BHC reduced it to 1 and 15·7, respectively.

SHENEFELT (R. D.). **Residual Effect of Chlordane on Crabgrass when applied to Lawns for Control of Sod Webworm.**—*J. econ. Ent.* **45** no. 1 pp. 138–139, 1 ref. Menasha, Wis., 1952.

Larvae of an unidentified species of *Crambus* that were abundant on lawns in central Wisconsin in 1949 were effectively controlled by an application of 1·5 lb. 50 per cent. DDT wettable powder in 25 U.S. gals. water or by one of chlordan emulsion at about 10 lb. actual compound per acre on 24th July. Neither material affected the lawn adversely, and in midsummer 1950, the strip sprayed with chlordan was much greener than that sprayed with DDT, owing to the absence from it of crab grass [*Digitaria sanguinalis*], which was still absent in 1951. Further tests indicated that the disappearance of this plant was due to the effect of chlordan on the seeds or very young plants, and B. H. Grigsby has recently found that chlordan inhibits the germination of crabgrass seeds in the greenhouse.

HANNA (R. L.) & GAINES (J. C.). **Insecticidal Control of Grasshoppers.**—*J. econ. Ent.* **45** no. 1 p. 139, 2 refs. Menasha, Wis., 1952.

In further investigations on the control of *Melanoplus differentialis* (Thos.) at College Station, Texas, in 1951 [*cf. R.A.E.*, A **38** 367; **39** 273], plots subject to reinfestation were sprayed with 0·06 or 0·12 lb. dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], 0·1 or 0·15 lb. aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene], 0·22 or 0·4 lb. heptachlor [1 (or 3a),4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene] and 0·81 or 1·44 lb. toxaphene in about 5 U.S. gals. spray per acre, and counts of the living grasshoppers taken per 100 sweeps of the net were made before treatment and five times at intervals of four days after it. The results showed that the percentages of the original population represented by the numbers taken after treatment averaged 12·7 and 8·1 for dieldrin, 18·3 and 21 for aldrin, 19·7 and 19·4 for heptachlor and 30·1 and 21·8 for toxaphene, as compared with 74·2–76·4 for no treatment. Dieldrin was significantly more effective and remained toxic longer than the other materials. There were no significant differences between the lower and higher rates of application of the insecticides, but dieldrin lost its effectiveness more rapidly at the lower than at the higher rate towards the end of the test period.

RIEDEBURG (T.). **Compound A42—Arsenomethane As-1,2 Disulfide, a new organic arsenical Insecticide.**—*Agric. Chem.* **7** no. 4 pp. 52–53, 131, 133, 3 refs. Baltimore, Md., 1952.

The results are given of tests carried out in 1951 with arsenomethane As-1,2-disulphide (Compound A42), a solid that melts at 93°C., decomposes at 250-260°C., and contains 4·8 per cent. water-soluble arsenic. It is very soluble in carbon bisulphide, somewhat soluble in naphtha, chloroform and ethyl ester, slightly soluble in kerosene, ethyl alcohol, methyl alcohol, and methylated naphthalene and insoluble in xylene, petroleum ether, toluene and benzene.

Laboratory tests with the confused flour beetle [*Tribolium confusum* Duv.], a termite, the granary weevil [*Calandra granaria* (L.)] and carpet beetles, in which media resembling the natural environments of these insects were mixed with the toxicant at various concentrations and insects were confined in them in closed containers for definite periods, showed that the median lethal concentrations were 0·005, 0·05, 0·1 and 1 per cent., respectively, for the four insects. In tests with sprays and dusts at various concentrations against insects on growing plants, 0·5 lb. of the compound per 100 U.S. gals. gave 90 per cent. kill of grasshoppers, and 4 per cent. in bran and 5 per cent. in calcium hydroxide gave about 50 per cent. kill, with little or no scorching of grass.

A 5 per cent. dust gave about 50 per cent. kill of adults of the Japanese beetle [*Popillia japonica* Newm.] and larvae of the Colorado potato beetle [*Leptinotarsa decemlineata* (Say)], with severe scorching of potato plants in the case of the latter, and 2-4 per cent. dusts gave 50 per cent. kill of third-instar larvae of the Mexican bean beetle [*Epilachna varivestis* Muls.] on bean, with severe damage to the plants.

Comparative tests showed that the median lethal concentrations of crude and purified arsenomethane As-1,2-disulphide for *T. confusum* were 0·015 and 0·005 per cent., as compared with 2, 0·25, 0·015 and 0·0005 per cent. for calcium arsenate, rotenone, DDT and parathion, respectively. The median lethal concentrations of the crude compound, calcium arsenate and rotenone were 2–4, 5 and 0·15 per cent. for *E. varivestis*, and those of these materials and DDT were 0·25, 2·5, 0·5 and 2 per cent. for the German cockroach [*Blattella germanica* (L.)] and 1,4,0·25 and 2·5 per cent. for *L. decemlineata.*

In phytotoxicity tests, the maximum spray concentrations that caused no plant injury after one application were 0·5 lb. per 100 U.S. gals. for potato, 0·25 lb. for tomato and cucumber, 0·1 lb. for peach and 0·075 lb. for apple, but higher concentrations proved safe on some of these plants when calcium hydroxide was added as a corrective or the compound had been washed to decrease its solubility in water. Peppers [*Capsicum*] were not injured by two applications of 0·25 lb. per 100 U.S. gals. In single dust applications, 10, 3 and 1 per cent. in calcium hydroxide and 5, 1 and 0·5 per cent. in Attaclay did not injure peppers, peach, pear, tomato, potato and bean, respectively; 1 per cent. in Attaclay did not injure tomato or pear after two and three applications, respectively, and 0·5 per cent. in Attaclay did not injure apple after two. Some concentrations that caused no injury after one application caused definite injury after two or three.

Research is in progress on the toxicity to warm-blooded animals, and until complete results are available, the same precautions are recommended as are used in handling DDT or benzene hexachloride.

TURNER (W. F.). **Insect Vectors of Phony Peach Disease.**—*Science* **109** no. 2822 pp. 87–88, 1 ref. Lancaster, Pa., 1949.

In view of the heavy losses of peach trees caused in the south-eastern United States by the virus disease known as phony peach, cooperative investigations on its possible insect vectors [*cf. R.A.E.*, A **25** 178] were begun in 1936. Insects of 53 species were tested, and four Jassids, *Cuerna costalis* (F.), *Graphocephala versuta* (Say), *Homalodisca triquetra* (F.) and *Oncometopia undata* (F.), were shown to be vectors, the other insects giving negative results. In preliminary tests in 1939–44, in an area in which the trees were not protected from natural infection, the first three Jassids each apparently infected one tree, and one of the controls became infected. More detailed tests were carried out in Georgia in 1945–46, when Jassids collected on peach, shrubs and weeds were confined in cheese-cloth bags on diseased trees for 4–5 days, after which the bags containing them were transferred to healthy trees in large screened cages and left for at least 30 days, except when all the insects died sooner. These tests were carried out during April-October in each year, and the trees were transplanted during the winter to areas where the disease was rare or unknown. None of the controls developed the disease, but of the 206, 64, 26 and 20 trees to which *H. triquetra*, *C. costalis*, *O. undata* and *G. versuta* were transferred, respectively, 8, 1, 3 and 2 became definitely infected and 8, 2, 0 and 0 probably so. The incubation period lasted 1½–3 years. *H. triquetra*, *G. versuta* and *O. undata* are all associated with peach trees at certain seasons; *C. costalis* is only doubtfully associated with peach, but survives for at least a month when confined on it.

PHILLIPS (J. H. H.). **An annotated List of Hemiptera inhabiting Sour Cherry Orchards in the Niagara Peninsula, Ontario.**—*Canad. Ent.* **83** no. 8 pp. 194–205, 7 refs. Ottawa, 1951.

A list is given of over 100 species of Hemiptera taken on sour cherry trees or on the plants beneath them in orchards in the Niagara Peninsula, Ontario, during 1947–50, with indications of their food-plants where known. They included a few predators.

WILDE (W. H. A.). **A Bi-valve Type of Insect Feeding Cage.**—*Canad. Ent.* **83** no. 8 pp. 206–208, 3 figs. Ottawa, 1951.

Studies in the Kootenay Valley, British Columbia, on the possible insect vectors of the virus disease known as little cherry have required the caging of insects on the branches of healthy cherry trees. The muslin cages first used proved unsatisfactory because of the high temperatures that developed in them, which, with other factors, caused high mortalities. An improved cage was accordingly designed and is described. It comprises two half cylinders, one of 32-mesh plastic screen and the other partly of screen and partly of celluloid ; both have wooden end-pieces, and they are hinged together at one side and fastened by means of hooks on the other. Each end-piece is fitted with two sponge rubber sections that form a tight closure round the branch, and there is a simple self-closing insertion valve comprising a strip of rubber stapled to the screen, through which a vial or an aspirator tube can be inserted for the introduction or removal of insects. The advantages of a cage of this type are that it allows only the minimum increase in temperature, there is no risk of the insects becoming entangled with the sides, it gives protection from rain, is cheap, durable and easy to construct, and can be used to enclose any part of a branch or a whole plant growing in a pot. Insects can be anaesthetised or killed while in the cage by wrapping a sheet of oil-cloth round it and introducing a piece of cotton soaked in ether or a cyanide preparation.

PIELOU (D. P.) & GLASSER (R. F.). **Selection for DDT Tolerance in a beneficial Parasite, *Macrocentrus ancylivorus* Roh. I. Some Survival Characteristics and the DDT Resistance of the original Laboratory Stock.**—*Canad. J. Zool.* **29** no. 2 pp. 90–101, 2 pls., 8 figs., 14 refs. Ottawa, 1951.

The introduced parasite, *Macrocentrus ancylivorus* Rohw., has given effective control of the oriental fruit moth [*Cydia molesta* (Busck)] on peach in the Niagara peninsula, Ontario [*cf. R.A.E.*, A **28** 422], but extensive spraying with DDT, which is now used as a supplementary measure, might result in its elimination. Attempts are therefore being made to raise a laboratory stock of parasites resistant to DDT in order to safeguard against this possibility, and the preliminary investigations are described in this paper. Experiments on the factors affecting natural mortality indicated that the mean survival period of females having access to sugar solution is about five days. When water, but not food, was provided, this period was reduced to 1·5 days, but in the absence of water and in dry air, there was little further reduction. Adequate nutrition, therefore, appeared the main survival factor. The effect of DDT on the parasites was tested by confining adults on deposits of crystalline DDT for a few minutes. Deposits were prepared by dissolving pure p,p'DDT in a solution of 0·2 per cent. celloidin (a mixture of the lower nitrates of cellulose) of the usual histological grade in a mixture of equal parts by volume of absolute ethyl alcohol and anhydrous ethyl ether, running 0·15 ml. of the solution on to a circular area 2 ins. in diameter on a lantern cover glass and, after about 30 seconds, inducing crystallisation by touching with a needle that had already been in contact with the insecticide ; provided that evaporation of the solvents

was slow, a uniform deposit of evenly branching crystals was obtained. The films retained their toxicity for months. When young adults of *M. ancylivorus* were confined for 1–8 minutes on films prepared from a solution of 0·3 per cent. DDT and calculated to contain 23 mmg. insecticide per sq. cm., initial mortality was high, and males were more susceptible than females. Comparison with mortality among untreated controls indicated that the toxic action was complete in 40 hours, the subsequent deaths being due to natural mortality, and that the DDT had destroyed those insects of which the natural life span would have been short. It was therefore proposed to use treated insects with the longest survival periods as parents from which to rear a resistant stock, although there is at present no evidence to suggest that a genetic element is involved in the variation noted.

CUMBER (R. A.). **The Introduction into New Zealand of** *Microphanurus basalis* **Woll. (Scelionidae : Hym.), Egg-parasite of the Green Vegetable Bug,** *Nezara viridula* **L. (Pentatomidae).**—*N.Z. J. Sci. Tech.* **32** (B) no. 5 pp. 30–37, 2 refs. Wellington, N.Z., 1951.

Notes are given on the bionomics of the recently introduced *Nezara viridula* (L.) in northern New Zealand, together with an account of the introduction and liberation against it of the egg-parasite, *Microphanurus basalis* (Woll.), from Australia, much of which has been noticed from earlier reports [*R.A.E.*, A **40** 29–30]. The parasites were collected in Australia under seasonal conditions in advance of those in New Zealand, and a place where the host was sufficiently advanced to enable a supply of eggs to be obtained was accordingly sought as a rearing centre. A locality on the Bay of Islands was finally selected, and since the egg-masses were difficult to find in numbers in the field, further supplies were obtained by confining adults in a large muslin cage containing potato plants and leafy branches of *Cassia*, from which the eggs were collected and kept in storage at 7°C. [44·6°F.] until required. A stock of 9,000 eggs had accumulated by the end of January 1949, when 200–300 parasite adults, comprising equal numbers of the sexes, and three parasitised egg-masses of *N. viridula* were received by air from Canberra. A few of the adults were dead, and one egg-mass had dried up, but about 110 males and 20 females were reared from the other two. The parasites were confined in tubes with host eggs and strips of paper bearing drops of diluted honey, and males and females of the new generation began to emerge 17 and 20 days later, respectively. The sex ratio was estimated to be one male to 3·3 females [*cf.* **26** 457–458].

SPILLER (D.). **Note on Susceptibility of** *Pinus radiata* **D. Don Timber to Attack by the Common House Borer** *Anobium punctatum* **De Geer.**—*N.Z.J. Sci. Tech.* **32** (B) no. 5 pp. 38–39, 1 fig. Wellington, N.Z., 1951.

The variation in susceptibility to attack by *Anobium punctatum* (Deg.) of timber from *Pinus radiata* was investigated in New Zealand during 1945–50. Flitches were taken from four trees in July 1945, air-dried until October and then sawn into boards representing the successive layers of timber from the central pith to the outer edge of the log. The boards were cut into blocks 4·5 × 2·5 × 1·2 ins. in size, and these, together with others cut from sapwood of *Podocarpus dacrydioides*, were each enclosed with five pairs of adults of *A. punctatum* in December. Counts were made of the exit holes in the blocks after the flight periods of 1947–48, 1948–49 and 1949–50. It was found that one of the *Pinus* logs was considerably less susceptible to attack than the other three, and that in all four susceptibility decreased from bark to pith. *Podocarpus* was more susceptible than *Pinus*.

HARROW (K. M.). **Preservative Treatment of Tawa (*Beilschmiedia tawa* Benth. and Hook. F.) by Pressure Impregnation.**—*N.Z. J. Sci. Tech.* **32** (B) no. 5 pp. 44–48, 7 refs. Wellington, N.Z., 1951.

The wood of *Beilschmiedia tawa* is becoming of increasing importance in New Zealand, but its use is limited by its high susceptibility to attack by *Lyctus brunneus* (Steph.). Experiments were therefore made to determine whether this timber can be successfully treated by means of pressure impregnation with preservatives, and boric acid was selected for the purpose because of the relative ease of its chemical analysis. The concentration of the solution used was such that it would produce an average loading of 0·2 per cent. boric acid with treatment at pressures rising to 200 lb. per sq. in. With treatment at 65°C. [149°F.] and with a final solution pressure of 200 lb. per sq. in., net absorption, expressed as a percentage of the weight of oven-dried wood, ranged from 79·8 per cent. after an initial vacuum of 20 ins. mercury to 49·1 per cent. after treatment under air pressure of 20 lb. per sq. in. A safety factor was computed from the loading data to account for the variation in loading of the boric acid between boards and the distribution of the boric acid within boards.

STRICKLAND (A. H.). **The Dispersal of Pseudococcidae (Hemiptera-Homoptera) by Air Currents in the Gold Coast.**—*Proc. R. ent. Soc. Lond.* (A) **25** pt. 1–3 pp. 1–9, 5 refs. London, 1950.

Since the crawlers of *Pseudococcus* spp. and related mealybugs, which are the most efficient vectors of the viruses that cause swollen-shoot disease of cacao in the Gold Coast [*R.A.E.*, A **37** 315], are believed to be dispersed by air currents [**37** 87], the extent to which this form of dispersal takes place was investigated during 1947–48. Traps of the stove-pipe type [**36** 195], 2 ft. high and 6 ins. in diameter, were painted white, coated with a preparation of benzene hexachloride in an adhesive base, and fixed to poles placed in situations where they were not overhung by trees. Three were in clearings on cacao farms at altitudes of about 700 ft. and were 20–30 ft. from the nearest cacao trees ; of these, two were placed with their base at a height of 10 ft. above the ground, and the other at 2 ft. The other two traps were on hill tops, one at an altitude of 1,400 ft. and 300 ft. from the nearest cacao, and the other at 2,100 ft. and one mile from the nearest cacao. Counts were made at fortnightly intervals for a year. The total numbers of insects caught per trap varied, but were lower in the cacao clearings than on the hill tops. There was no correlation between the total numbers of insects trapped and rainfall, but statistical analysis showed that apterous forms considered together and (with one exception) Coccids considered separately were significantly more numerous in dry weather than during periods of heavy rain. Coccids, almost all of which belonged to the genus *Pseudococcus*, were not numerous, but were more abundant in the cacao clearings than on the hill tops. They were commoner at a height of 2 ft. than at 10 ft., and this is attributed to the carriage of complete mealybug ovisacs by ground-level air currents in February 1948. The occurrence of this was suggested by the finding of large numbers of crawlers grouped in small areas on the trap.

POTTER (C.). **An improved Laboratory Apparatus for applying direct Sprays and Surface Films, with Data on the electrostatic Charge on atomized Spray Fluids.**—*Ann. appl. Biol.* **39** no. 1 pp. 1–28, 1 pl., 5 figs., 22 refs. London, 1952.

The following is the author's summary. A description is given of the design and physical performance of a laboratory spraying apparatus, which is an improved version of that described by the author in 1941 [*R.A.E.*, A **29** 591].

This apparatus is shown to be capable of giving good replication and an even distribution over a circular area 9 cm. in diameter with distilled water, a light petroleum oil and a heavy petroleum oil. It may therefore be used with a variety of media either for direct application to the organism, or for the application of residual films. With distilled water a difference in the environmental temperature of 20°F., between 60 and 80°F., produced approximately 10 per cent. difference in the deposit and a difference of 20 per cent. in the relative humidity of the environment between 60 and 80 per cent. produced approximately 5 per cent. difference in the deposit, so that it does not appear that closely controlled conditions, although desirable, are necessary for good replication.

A short investigation was made of the electrostatic effects, to try to determine whether variation in electrostatic charge could cause variation in weight of deposit. Tests using a copper spray target and a Perspex target indicated that electrostatic charge on the target itself was not important. It was found that the charge on the droplets of aqueous sprays varied considerably with the solute. In the presence of two non-ionic surface active agents the charge was greatly increased over distilled water, while in the presence of an anionic material it was reduced so that it could not be measured with the available apparatus. Other materials produced intermediate effects. The difference in charge did not appear to be due to differences in degree of atomisation. In a given set of conditions a droplet of distilled water of average weight 0·00013 mg. at a potential of 25 volts carries a charge of 0·00026 electrostatic units and a droplet of 5 per cent. v/v Lissapol N of average weight 0·000084 mg. at a potential of 49 volts carries a charge of 0·00044 electrostatic units.

However, there appeared to be no correlation between the charge on the droplet and the amount deposited, and this, together with further evidence obtained by applying potentials up to 1,500 volts on the spray target, indicated that variations in electrostatic charge on the droplets were not likely to cause variation in the amount deposited, under the conditions of application in the apparatus.

It was concluded that the main cause of the variations of deposit that occurred in a series of measurements was likely to be difference in the amount of turbulence occurring in the spray tower, but that there were probably other sources that had not yet been recognised. The weight of deposit must therefore be checked constantly.

References are given to work illustrating the biological results obtainable with the apparatus [**39** 50, 427].

CADMAN (C. H.). **Studies in *Rubus* Virus Diseases. II. Three Types of Vein Chlorosis of Raspberries.**—*Ann. appl. Biol.* **39** no. 1 pp. 61–68, 2 pls., 6 refs. London, 1952.

Commercial stocks of raspberries in Britain are commonly attacked by three types of vein chlorosis of which the symptoms differ in severity and for which the names mild, moderate and severe vein chlorosis are proposed. There is some evidence that they may be caused by related strains of one virus. *Aphis idaei* v.d. Goot was shown in an earlier paper to be a vector of moderate vein chlorosis, which was at that time identified as curly dwarf [*R.A.E.*, A **38** 470], but the relations of that Aphid to the mild and severe diseases have not yet been established. In addition to descriptions of the symptoms produced by these diseases on the Norfolk Giant variety, this paper contains an account of experiments in which they were transmitted by grafting to other varieties and a recapitulation of the results of the experiments in which moderate vein chlorosis was transmitted by Aphids [*loc. cit.*].

CADMAN (C. H.). **Studies in *Rubus* Virus Diseases. III. A veinbanding Disease of Raspberries.**—*Ann. appl. Biol.* **39** no. 1 pp. 69–77, 1 pl., 14 refs. London, 1952.

A chlorotic veinbanding disease of raspberry that is common in Britain was found on plants of the variety Norfolk Giant in eastern Scotland in 1944. In experiments, the virus that causes it was transmitted by batches of *Amphorophora rubi* (Kalt.) that had fed for 18 hours or more on infected plants, and it persisted in the vectors for not more than 24 hours. The symptoms that it caused on a wide range of European and North American varieties to which it was transmitted by grafting are described. The symptoms are masked in hot weather, and are analogous on the North American varieties to those of the red raspberry mosaic of American authors [*cf. R.A.E.*, A **15** 598]. The name raspberry veinbanding virus is proposed for it.

BRADLEY (R. H. E.). **Studies on the Aphid Transmission of a Strain of Henbane Mosaic Virus.**—*Ann. appl. Biol.* **39** no. 1 pp. 78–97, 1 graph, 20 refs. London, 1952.

The following is taken largely from the author's summary. A virus that causes a wilt disease of *Datura stramonium* in southern England was identified as a strain of henbane mosaic virus. It causes necrotic local lesions in *Nicotiana rustica*, and local lesions are demonstrable in tobacco by staining with iodine. Some of the factors affecting its transmission to these plants by *Myzus persicae* (Sulz.) were studied quantitatively by means of such lesions. Infective Aphids differed little in their ability to cause infection and usually produced 2–3 lesions each. Fasting Aphids usually probe the leaves several times with the proboscis before feeding continuously, each act of probing lasting less than a minute. The duration of the probing act did not affect the number of lesions subsequently made per Aphid, and the highest percentage of Aphids became infective after probes lasting 10–20 seconds. Transmissible virus did not seem to be continually imbibed while Aphids fed on infected plants, and there were indications that it was acquired immediately before the Aphids withdrew their stylets from the leaf. Aphids became infective when allowed to probe the epidermis stripped from infected leaves. The Aphids transmitted the virus during acts of probing as brief as 5–10 seconds ; the probability of a single probe resulting in infection was greatest when it lasted 20–30 seconds, during which the stylets did not penetrate as far as the centre of the epidermal cell and little or no saliva appeared to be ejected. The Aphids did not transmit the virus when the stylets were artificially wetted with infective sap. Periods of darkness before inoculation with the virus increased the susceptibility of *N. rustica* to infection by rubbing, but not to infection by *M. persicae*.

ZUCKERMAN (S.). **Toxic Chemicals in Agriculture. Report to the Minister of Agriculture and Fisheries of the Working Party on precautionary Measures against toxic Chemicals used in Agriculture.**—iii+16 pp. London, H.M.S.O., 1951. Price 1*s*.

This report contains the findings of a working party appointed in 1950 to investigate the risks to agricultural workers associated with the use of recently developed insecticides and weed-killers in Britain. The materials dealt with are DNC (dinitro-o-cresol), dinitro-o-sec.-butylphenol and their salts, considered as weed-killers, and parathion, TEPP [tetraethyl pyrophosphate] and schradan [bisdimethylaminophosphonous anhydride]. Several deaths and cases of mild poisoning have been caused by DNC used as a weed-killer in summer, but its use at a lower concentration as a dormant spray on fruit trees

has proved harmless. At least two cases of parathion poisoning of moderate severity have occurred. Other aspects considered comprise the case for the continued use of the materials, their mode of action in man, and the circumstances in which poisoning has occurred. The protective measures stated to be in use or suggested in evidence are reviewed. It is concluded that the use of these materials is essential until substitutes have been discovered, and recommendations are made regarding the protective and preventive measures to be adopted by or on behalf of agricultural workers engaged in spraying, the manufacturers' responsibilities with regard to labelling containers and giving prior notification of preparations of newly developed compounds, and lines along which future research should be directed, as well as for precautionary measures to reduce risk to the general public.

VOGEL (W.). **Eibildung und Embryonalentwicklung von *Melolontha vulgaris* F. und ihre Auswertung für die chemische Maikäferbekämpfung.** [Egg-formation and embryonic Development in *M. melolontha* and its Evaluation for chemical Control.]—*Z. angew. Ent.* **31** pt. 4 pp. 537–582, 33 figs., 66 refs. Berlin, 1950.

The author describes the life-cycle of *Melolontha melolontha* (L.) (*vulgaris* F.), largely from the literature and with special reference to Switzerland [*cf. R.A.E.*, A **31** 437] and gives detailed accounts of the female genitalia and the anatomy and development of the egg based on laboratory investigations.

The adults emerge from the soil in the second half of April, the males before the females, fly to the edges of the woods in the first half of May, and feed on the leaves, which open at about that time. The two sexes are equal in numbers. In mid-May, the females fly to the fields to oviposit and return to the woods after 2–6 days to feed again. A second period of oviposition follows, and there is sometimes even a third, though the number of beetles becomes reduced by that time. One method of control now practised is to apply insecticides to the trees against the feeding adults [*cf.* **39** 358], and since this should be done as late as possible before oviposition to allow the maximum development of the foliage and hence the best distribution of the poison, it is essential to be able to forecast the approximate date of oviposition. This can be done by observations on adult flight and on the state of the female genitalia. Methods proposed in the literature or developed in Switzerland are reviewed, with indications of which are suitable for field use and which for the laboratory, and recommendations for practice on a large scale are made.

The edges of woodlands are surveyed when emergence begins, and the sex ratio of 300 adults, collected each day, ascertained. When this reaches 1 : 1, emergence is complete. Simultaneous records are obtained of foliage development, and every 2–3 days 100 females are sent to the laboratory, where their ovaries are examined [*cf.* **16** 492]. Similar observations are made during the later feeding periods. As soon as the sex ratio reaches 1 : 1, treatment should be begun, provided that foliage development is satisfactory. Otherwise, it should be postponed for a little, but it should in any case be carried out before the first main oviposition flight or the return of any considerable number of females for further feeding. The results obtained by these methods are illustrated, mostly from work in Switzerland in 1949.

MÜLLER (F. P.). **Über Schadauftreten und Biologie von *Colaphellus sophiae* Schall. (Chrysomel.).** [On the Occurrence as a Pest and the Biology of *C. sophiae*.]—*Z. angew. Ent.* **31** pt. 4 pp. 591–608, 2 figs., 32 refs. Berlin, 1950.

Cabbage and radish seedlings growing on previously uncultivated ground in Berlin suffered severe defoliation in 1946 and 1947 by adults of *Colaphellus*

sophiae (Schall.), a Chrysomelid not previously of economic importance in Germany, and investigations on its bionomics were therefore made. Its distribution is reviewed from the literature. There was one generation a year. Most of the overwintered adults emerged from the soil in the laboratory in April-May, but a few did so in June. They fed on the leaves and flowers of wild and cultivated crucifers. Pairing occurred soon after emergence and was repeated frequently throughout adult life, which lasted 14–49 days. Oviposition began in May, the maximum total number of eggs deposited by any one female being 344. The eggs were normally laid in batches of up to 43, usually just below the surface of the soil. The larvae hatched in about a week, fed on the leaves of cruciferous plants for 12–13 days and then entered the soil, in which they rested for a further 12–13 days before pupating. The pupal stage lasted 11–17 days. Most of the adults remained in the pupal cells until the following spring. A few from pupae very near the surface left the soil in the laboratory after a few days, but took little or no food and did not reproduce. No emergence before the winter was observed in the field. The beetles were not seen to fly and migrated little, with the result that in 1947 their numbers varied according to the efficacy of control on each plot during the preceding year. In wet weather and at night, most of them sheltered in the soil beneath the plants, and they were present until July. The larvae caused insignificant damage to radish or cabbage, on which they were rare, but were numerous on cruciferous weeds. The greatest numbers of larvae were found in June and early July, and all had left the plants by early August.

It is concluded that outbreaks of *C. sophiae* occur where suitable cruciferous plants grow in the same place year after year, those in Berlin being associated with weeds not previously present that have recently become established. A few of the larvae were parasitised by the Tachinid, *Meigenia bisignata* (Mg.), and some by the Ichneumonid, *Eripternus tarsalis* Szépl. Another Ichneumonid, *Mesochorella nigriceps* (Brischke), which was possibly a parasite of *E. tarsalis*, was also reared from the larvae. Hand-collection of the adults was the best control measure against *C. sophiae*.

FREY (W.). **Über die Beziehungen zwischen der Wirksamkeit chemischer Bekämpfungsmittel und dem Entwicklungszustand des Rapsglanzkäfers** (*Meligethes aeneus* **F.).** [On the Relations between the Effectiveness of chemical Control and the Stage of Development of *M. aeneus*.]—*Z. angew. Ent.* **31** pt. 4 pp. 609–616, 1 graph, 3 refs. Berlin, 1950.

During laboratory experiments in Germany in 1941–42, the toxicity of dusts of derris or DDT (Gesarol) to adults of *Meligethes aeneus* (F.) was found to decrease in the course of the summer. Closer investigations on field-collected beetles in 1943 showed that the percentages of adults surviving one day after dusting with low concentrations of derris or DDT tended to vary directly with the percentages of newly emerged examples among the test insects, though it was sometimes increased in individuals with well developed fat-bodies, which appeared to show a certain resistance to poisoning. The significance of these facts in field and laboratory tests is discussed, and it is recommended that in field work on the control of the beetle on rape and other oil-producing crucifers, the dusting rate should be doubled or trebled if young adults are present.

BOVIEN (P.) & KNUDSEN (P.). **Krusesygegalmyggen** (*Contarinia nasturtii* **Kieff.), dens biologi og bekaempelse.** [The Biology and Control of *C. nasturtii*.]—*Tidsskr. Planteavl* **53** pp. 235–257, 1 fig., 15 refs. Copenhagen, 1950. (With a Summary in English.)

Contarinia nasturtii (Kieff.) (*torquens* de Meij.) has long been a serious pest of cabbage and cauliflower in Denmark [*cf. R.A.E.*, A **17** 300; **37** 322], and notes are given on its bionomics and the deformation of the plants that it causes

based on the authors' own observations and the European literature [*cf.* **17** 300 ; **19** 274 ; **26** 466 ; **32** 84]. There are at least three generations a year, and all the larvae of the last and some of those of the others overwinter in their cocoons in the soil, some completing their development in the following spring and others remaining in diapause for one or more years. In investigations in 1947–48, many of the larvae were found to be parasitised by the Miscogasterid, *Pirenisca* (*Pirene*) *eximia* (Hal.). In 1947, adults of the first generation of *Contarinia* emerged over about 13 days in late July, mostly between 20th and 24th, and those of the second between 12th and 20th August, but many diapausing larvae occurred in both generations. A few adults of the third generation emerged in September-October, and larvae were present on cauliflower until 13th October, though it was not known to what generation they belonged. In 1948, adults of the overwintered generation emerged in May-June and those of the first generation in mid-July. Experiments in which adults reared from swedes showing typical stalk deformation gave rise to larvae that attacked the flowers of healthy swede, and adults from galled cabbage flowers to larvae that caused twisting of the leaf-stalks and crinkling of the leaves of cabbage, confirmed the conclusion that *C. geisenheyneri* Rübs. is a synonym of *C. nasturtii* [*cf.* **38** 379].

Experiments on control were carried out in 1929–30 and again in 1947–48. The earlier tests confirmed the value of sprays of nicotine and soap [**26** 467] and methylated spirit and soap [**17** 404]. In the later ones, both adults and larvae were shown in the laboratory to be susceptible to DDT, and various proprietary materials were tested on cauliflower in the field. In 1947, plants from seed sown on 2nd June were dusted or sprayed with DDT preparations at suitable concentrations on 17th and 25th June and (after planting out) on 8th, 17th and 21st July and 4th and 18th August. After the two applications in the seed-beds, the percentage infestation was reduced from 32·2 for no treatment to 6 for the dust and 0·6 for the spray, and on 14th August it was 93 for no treatment, 51 for the dust and 49 for the spray. The last two field applications (and probably the first) are thought to have been unnecessary. In 1948, when sprays were applied twice to field plants on different combinations of dates, much the best results were given by treatment on 14th and 21st June, the infestation percentages being 1 for 0·5 per cent. Gesarol spray concentrate (25 per cent. DDT), 0·6 for 0·2 per cent. nicotine with 1 per cent. soap, 4 for 2 per cent. Midol A (which contains benzene hexachloride) and 1 for 0·02 per cent. Bladan (stated to contain a thiophosphoric acid ester), as compared with 35 for no treatment.

Plantesygdomme i Danmark 1947 (–1949). Plant Diseases and Pests in Denmark 1947 (–1949).—*Tidsskr. Planteavl* **53** pp. 185–234, 2 graphs ; **54** pp. 1–61, 2 graphs ; **55** pp. 1–81, 2 figs., 2 graphs ; also as *Arsovers. plantepat. Forsøg* nos. 64–66. Copenhagen, 1950, 1950, 1951. (With Summaries in English.)

These three reports contain sections (pp. 212–224 ; 32–47 ; 37–53, 58–60) in which P. Bovien surveys the principal pests of cultivated plants in Denmark in 1947–49 as in previous years [*cf. R.A.E.*, A **37** 322].

Insects of importance in more than one year included *Lema melanopa* (L.) on oats in 1947 and 1948, *Otiorrhynchus ligustici* (L.) on red clover [*Trifolium pratense*] and *Jaapiella medicaginis* (Rübs.) on lucerne in 1947 and 1949, *Aphis* (*Doralis*) *fabae* Scop. and *Silpha* (*Blitophaga*) *opaca* L. on mangels and beet, *Thrips angusticeps* Uzel and *Eurydema oleraceum* (L.) on swedes, *Phyllotreta* spp. on crucifers in general, *Trioza apicalis* Först. and *Psila rosae* (F.) on carrot, *Hoplocampa testudinea* (Klug) and *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple, all in all three years, *Cydia* (*Laspeyresia*) *funebrana* (Treitschke) on

plum in 1947 and 1949, *Malacosoma* (*Gastropacha*) *neustria* (L.) on various fruit trees in 1947 and 1948, and *Hylemyia antiqua* (Mg.) on onion in 1947 and 1948.

Other notable pests included *Pegomyia hyoscyami* (Panz.), an outbreak of which on mangels in 1947 was checked by parasitism of the eggs by *Trichogramma evanescens* Westw., *Otiorrhynchus singularis* (L.) (*picipes* (F.)) on currants, gooseberries and raspberries in 1947, *Hadena* (*Mamestra*) *trifolii* (Rott.), which severely attacked sugar-beet at one locality in 1948 and was controlled by spraying with 0·5 per cent. paris green, *Lygus pabulinus* (L.) on tobacco in 1947 and potato in 1948, *Rhynchaenus* (*Orchestes*) *fagi* (L.), adults of which injured fruits, especially those of apple and cherry, in 1947 by gnawing the surface, *Adoxus* (*Bromius*) *obscurus* (L.), which caused similar damage to apples in 1948, *Eriosoma lanigerum* (Hsm.), which spread to apple in several fresh localities in 1949 and was not well controlled by *Aphelinus mali* (Hald.), though the latter also increased its distribution, and *Pyrausta nubilalis* (Hb.), which is normally very rare in Denmark, but was common on the island of Bornholm in 1947, when the larvae were found in the stems of *Chrysanthemum*, *Dahlia* and *Artemisia*.

Pests recorded for the first time in Denmark included *Psylla pyrarboris* Šulc on pear and *Dialeurodes chittendeni* Laing on rhododendron, both in 1947, and *Leptinotarsa decemlineata* (Say) on potato [*cf.* **39** 130, 291] and *Vasates* (*Phyllocoptes*) *schlechtendali* (Nal.) on apple, both in 1949. Notes on the control measures adopted against some of the pests and their results are included.

SYLVÉN (E.). **Om rapsens reaktion för skidförlust under senare delen av och strax efter skidsättningen. Ett bidrag till kännedomen om skidgallmyggans** (*Dasyneura brassicae* **Winn.) betydelse som skadedjur.** [The Reaction of Rape to Loss of Pods during the late Stage of Pod Formation and immediately after it. A Contribution to Knowledge of the Bladder Pod Midge, *D. brassicae*.]—*Medd. St. Växtskyddsanst.* no. 56, 31 pp., 4 graphs, 4 refs. Stockholm, 1950. (With a Summary in English pp. 26–30.)

In view of uncertainty as to the ultimate effect on seed yield of injury to the pods of rape by *Dasyneura brassicae* (Winn.) [*cf. R.A.E.*, A **40** 54], experiments were carried out in southern Sweden in 1949 in which 10–90 per cent. of the healthy pods of winter rape and 10–70 per cent. of those of spring rape were removed during the later stages of pod formation or immediately after it, to simulate damage by the Cecidomyiid. The pods on the treated plants were counted at harvest and the seed weighed, and the results, which are given in tables and discussed, were compared with those from untreated plants. They indicated that the plants have considerable regenerative power, particularly those of spring rape, and that although the numbers of pods at harvest fell off with increase in the percentage originally removed, the weight of seed per pod increased. The amount of compensation afforded by these means decreased, however, with the percentage of pods removed, so that although light or moderate infestation by *D. brassicae* might have little or no effect on total seed yield, severe infestation would reduce it.

LEKANDER (B.), MATHIESEN (A.) & RENNERFELT (E.). **Om almsjukan samt råd och anvisningar för dess bekämpande.** [On the Dutch Elm Disease, with Advice and Directions for its Control.]—*Flygbl. St. Skogsforskningsinst.* no. 65, 8 pp., 5 figs. [Stockholm, 1952.]

LEKANDER (B.). **Almsjukan—en ny farlig sjukdom på våra almar.** [The Dutch Elm Disease—a new and dangerous Disease for our Elms.]—*Lustgården* 1950–51 pp. 72–78, 5 figs., 1 ref. Landskrona, 1951.

It is stated in the first of these papers that Dutch elm disease, caused by *Ceratostomella ulmi*, was observed on elms for the first time in Sweden in

Stockholm in the spring of 1950. A survey later in the year showed that it was widespread in the city and its environs, 20 per cent. of the elms in one park being seriously and 25 per cent. lightly attacked, and was also present in two other localities. Infected elm timber was found at several ports, and it is thought that the disease was introduced with unbarked elm wood. The world distribution of the disease, the mode of development of the fungus and the damage that it causes to the trees are described.

Four species of *Scolytus* that could serve as vectors of the fungus are common in Sweden, and notes are given on their bionomics. They have only one generation a year, overwinter usually as pupae, *S. laevis* (Chap.) in the sapwood and the others in the bark, and give rise to adults in May–June. Before becoming sexually mature, the adults feed in the crowns of the trees for a few days. Breeding occurs only in weakened or dead trees. Methods of preventing the spread of the disease and of the insect vectors are discussed from the literature. With the exception of two Asiatic species, all the wild and cultivated elms of Sweden are susceptible to infection. The import of elm plants, elm bark and unbarked elm timber was forbidden by regulation in January 1951.

The second paper is a slightly shorter account of the same information.

FJELDDALEN (J.). **Systemiske midler. Biokjemisk bekjemping av skadedyr.** [Systemic Insecticides. Biochemical Control of Pests.]—*Gartneryrket* 1950 no. 47 repr. 12 pp., 2 figs., 12 refs. Oslo, 1950. (With a Summary in English.)

The author reviews the literature on systemic insecticides and gives a short account of tests carried out in Norway with Pestox 3, containing 66 per cent. schradan (octamethyl pyrophosphoramide), and Systox, containing 50 per cent. active ingredient [diethyl ethylmercaptoethyl thiophosphate]. When applied in sprays, 0·1–0·15 per cent. Pestox 3 and 0·05 per cent. Systox gave almost complete mortality of *Myzus cerasi* (F.) on cherry, *Anuraphis roseus* Baker (*Yezabura malifoliae*, auct.) on apple, Aphids on *Dahlia* and carnation, and *Tetranychus telarius* (L.) (*althaeae* v. Hanst.) on fig and strawberry. Dipping *Hedera canariensis* infested by *Saissetia coffeae* (Wlk.) (*Lecanium hemisphaericum* Targ.) twice at an interval of 14 days in 0·1 per cent. Pestox 3 and 0·05 per cent. Systox killed 20–30 and 80–90 per cent., respectively, of the immature Coccids, but had little effect on the adults. No damage was caused to any of the plants. The systemic effect was less on mature plants than on growing ones, and leaves became more toxic to Aphids and mites than shoots or stems. Systox was more rapid in action than Pestox 3, probably owing to its fumigant effect.

PAPERS NOTICED BY TITLE ONLY.

PETCH (T.). **A revised List of British entomogenous Fungi.**—*Trans. Brit. mycol. Soc.* **31** pt. 3–4 pp. 286–304, London. 1948. [*Cf. R.A.E.*, A **21** 87.]

BUCK (J. B.) & KEISTER (M. L.). **Respiration and Water Loss in the Adult Blowfly, *Phormia regina*, and their Relation to the physiological Action of DDT.**—*Biol. Bull.* **97** no. 1 pp. 64–81, 9 figs., 14 refs. Lancaster, Pa., 1949. [See *R.A.E.*, B **40** 92.]